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THE IMPORTANCE OF SPORTING ACTIVITIES IN MUSICAL INSTRUMENT PERFORMANCE

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ABSTRACT

Engagement in physical activities by individuals playing an instrument is of paramount importance due to the positive effects conferred upon both physical and mental health. Instrumental performance emerges as a phase wherein focus, coordination, and cognitive-motor skills coalesce. During the formative process of this phase, the performer engages in a series of physical actions; however, these activities may paradoxically induce inactivity in specific muscle groups. This condition can precipitate various physical impairments, specifically Playing-Related Musculoskeletal Disorders (PRMDs). It is at this juncture that the significance of physical activity becomes evident. For instrumentalists, engaging in sports is crucial not only for fortifying physical conditioning but also for exhibiting a robust mental stance. Concurrently, it enhances their capacity for self-expression through improved emotional regulation. Systematic physical activity serves to preserve musculoskeletal integrity, thereby minimizing the tension and regional pain associated with prolonged periods of sedentary practice. The adoption of a habitual sports regimen by instrumentalists may lead to significant improvements in general quality of life and energy levels, consequently optimizing the efficacy of intensive practice sessions and enhancing overall performance quality. Beyond physiological benefits, physical activities provide substantial psychological advantages, including stress reduction, augmented concentration, and ameliorated

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attentional focus. The endorphin release stimulated by exercise fosters a state of well-being and relaxation, enabling the individual to experience a calmer and more gratifying performance. Furthermore, sports habits facilitate socialization and enhance communicative competence within ensemble settings, thereby encouraging cross-cultural musical interaction and fostering group cohesion.

Keywords: Sports and music, instrument, physical activities, music performance, musician health.

ÇALGI İCRASINDA SPORTİF FAALİYETLERİN ÖNEMİ

ÖZ

Enstrüman icra eden bireylerin fiziksel aktivitelere katılımı hem fiziksel hem de zihinsel sağlık üzerindeki olumlu etkileri nedeniyle son derece önem teşkil etmektedir. Enstrüman performansı odaklanma, koordinasyon ve bilişsel-motor becerilerin birleştiği bir aşama olarak ortaya çıkar. Bu aşamanın oluşum sürecinde ise icracı bir dizi fiziksel eylemde bulunur; ancak bu aktiviteler, paradoksal olarak belirli kas gruplarında hareketsizliğe neden olabilir. Bundan dolayı özellikle Çalmaya Bağlı "Kas-İskelet" Bozuklukları (PRMD'ler) olmak üzere çeşitli fiziksel bozukluklara yol açabilir. İşte bu noktada fiziksel aktivitenin önemi ortaya çıkmaktadır. Enstrüman icracıları için spor yapmak sadece fiziksel kondisyonu güçlendirmek için değil, aynı zamanda güçlü bir zihinsel duruş sergilemek için de çok önemlidir. Eş zamanlı olarak gelişmiş duygusal düzenleme yoluyla kendini ifade etme kapasitelerini artırır. Sistematik bir şekilde uygulanan fiziksel aktiviteler "Kas-İskelet" bütünlüğünü koruyarak uzun süreli hareketsiz uygulamalarla ilişkili gerginliği ve bölgesel ağrıyı en aza indirir. Enstrüman icra eden müzisyenlerin düzenli bir spor programı benimsemesi genel yaşam kalitesinde ve enerji seviyelerinde önemli iyileşmeleri beraberinde getirebilmektedir. Böylelikle yoğun çalışma seanslarının etkinliğini optimize edilerek genel icra performansının kalitesi artırılabilir. Sportif aktiviteler fizyolojik faydaların ötesinde fiziksel aktiviteler stres azaltma, konsantrasyonu artırma ve dikkat odağını iyileştirme gibi önemli psikolojik avantajları da sağlamaktadır. Egzersizle bireyde uyarılan endorfin salınımı, iyilik ve rahatlama hali yaratmaktadır. Ayrıca bireyin daha sakin ve daha tatmin edici bir performans sergilemesini de sağlamaktadır. Diğer yandan spor alışkanlıkları hem sosyalleşmeyi kolaylaştırırken hem de topluluk ortamlarında iletişimsel yetkinliği artırarak kültürlerarası müzikal etkileşimi teşvik eder ve grup uyumunu da güçlendirebilmektedir.

Anahtar Kelimeler: Spor ve müzik, enstrüman, fiziksel aktiviteler, müzik performansı, müzisyen sağlığı.

INTRODUCTION

While music and sports may appear as distinct disciplines, they occupy a significant and intersecting locus in human life. When the complementary elements of these disciplines are examined, commonalities in human psychology, physiology, and social structure become evident (Lane & Kreider, 2025: 2-4). The phenomena of music and sports are pivotal for both individual development and societal advancement. Supporting the synergy between these two domains with empirical studies constitutes a critical process in academic inquiry. The connection between music and sports focuses not only on positively influencing physical health and aesthetic dimensions but also on mental health, self-efficacy, the regulation of the emotional system, and social interaction (Karageorghis & Priest, 2008: 209-238). In this context the effects emerging from the music-sport

relationship are determinant in generating positive outcomes for individuals. Sport has been the focus of extensive research regarding its psychological and physiological benefits for the human body. These studies highlight details such as muscle development, increased endurance (resistance), and stress alleviation (Sundstrup et al., 2016: 237-248). A separate study emphasized that mitochondrial content and oxidative capacity are positively triggered following endurance and strength training (Hughes et al., 2018: 1-17). A parallel situation is observable within the realm of music. Positive effects manifest in the mental and physical processes of individuals engaged with music. Numerous studies have demonstrated that both musical training (instrumental or vocal performance) and the act of listening to music facilitate psychological relaxation, minimize stress, and establish a robust psychological foundation (Knight & Rickard, 2001: 254-272). Specifically, one study concluded that physiological stress levels were significantly lower in piano students compared to those engaged in other artistic activities (Toyoshima et al., 2011: 257-264).
Considering the nexus of music and sports it is observed that these two distinct disciplines reveal various mutually supportive characteristics. For instance, scientific studies have shown that listening to music during sports positively affects personal performance, elevating motivation to higher levels (Ballmann, 2021: 8-12). Furthermore, improvements in attentional processes are visible. Various studies on sports indicate that individuals listening to music overcome the difficulty levels of physical activities more comfortably, positively impacting their performance and motivation (Okano et al., 2015: 116). Other research has found increases in rhythm perception, feelings of pleasure, and anaerobic performance (e.g., sprinting, weightlifting) in athletes listening to up-tempo music (Pusey et al., 2023: 7-9). Thus, physical movements become more efficient when synchronized with the rhythmic structure of music. It must be underscored that the importance of sports for musicians primarily lies in its contribution to their cognitive and physical development. Within the scope of this research, specific problems arising during long hours of practice (etudes, exercises, etc.) and stage performances by instrumentalists will be addressed, and solutions will be sought regarding how these issues can be mitigated through physical activities. The importance of sports for instrumentalists will be emphasized in the context of coping with muscle fatigue, postural disorders (maladaptive posture), and factors inducing stress. This is a critical process for improving the quality of life for instrumentalists. Consequently, we can conclude that the bond between music and sports is robust. These insights will shed light on the relationship between instrumental performance and sports, which is the central theme of this research.

Problem Statement

Professional instrumental performance imposes significant physiological and psychological demands that are often underestimated in traditional music education curricula. Instrumentalists are frequently required to maintain static, asymmetric postures for extended periods while executing repetitive, fine motor movements under high cognitive load. This occupational necessity creates a predisposition for Playing-Related Musculoskeletal Disorders (PRMDs), including muscle rigidity, chronic pain, and maladaptive postural habits. Furthermore, the intense pressure of performance often leads to psychological challenges such as Music Performance Anxiety (MPA), mental fatigue, and social isolation due to solitary practice routines. Despite these risks, the integration of systematic physical conditioning into musical training remains insufficient, leaving musicians vulnerable to career-threatening injuries and burnout. While some leading conservatories worldwide (e.g., Berklee, Sibelius Academy, etc.) have physiological support units, our national music education curricula do not include such an “instrumental performance health” module as a standard. The proposed curriculum model is based on a hybrid training program that

includes strengthening muscle groups specific to instrumentalists, increasing postural awareness, and incorporating stretching routines. In this regard, the current study addresses this literature gap and seeks to answer the following fundamental research question: To what extent do systematic and branch-specific sports conditioning programs integrated into the music education curriculum reduce the incidence of musculoskeletal disorders in instrumentalists and, accordingly, to what extent do they affect psychological resilience and performance quality?

Research Aim

The primary aim of this study is to elucidate the critical role of systematic physical activity and sports engagement in mitigating the occupational health risks associated with instrumental performance. Specifically, the study seeks to:

1. Analyze the physiological mechanisms by which physical activity preserves musculoskeletal integrity and prevents PRMDs in musicians.
2. Examine the impact of sports on cognitive-motor skills, particularly rhythm perception, coordination, and focus.
3. Evaluate the efficacy of physical exercise as a regulatory strategy for managing stress and Music Performance Anxiety (MPA).
4. Propose a pedagogical framework for integrating sports consciousness into music education to enhance the long-term career sustainability and holistic well-being of instrumentalists.

Importance of Research

It fills a critical gap that traditional music education often overlooks and offers instrumentalists a roadmap for long-term career sustainability. By defining the musician as a "micro-scale athlete" the study demonstrates the value of sports not only as a rehabilitative but also as a preventative mechanism in preventing muscle imbalances and fatigue caused by static posture and repetitive movements. By highlighting the psychosocial benefits of physical activity, such as enhancing emotional regulation through endorphin release, reducing social isolation, and enhancing cohesion in ensemble work (e.g. orchestra), it demonstrates the necessity of its integration into the curriculum for instrumentalists' holistic well-being and optimization of performance quality.

Study Limitations

Although this study demonstrates the importance of physical activity for instrumentalists, there are significant limitations in the literature and methodology reviewed. Most empirical studies have typically been conducted with small sample sizes and short follow-up periods. This makes it difficult to definitively measure the long-term effects of exercise programs and their validity across large populations. A critical challenge lies in thoroughly determining the occupational risks associated with different instrument types (wind, string, etc.) and defining objective athletic training procedures specific to each group. Furthermore, key parameters such as the duration, intensity, and timing of activities aimed at reducing Music Performance Anxiety (MPA) remain unclear. Methodologically, to more accurately measure the effects on musicians' performance, neurosignaling with techniques such as EMG (electromyography), HRV (heart rate variability), or pupillometry (pupil measurement) is needed, and larger, randomized controlled trials combining the disciplines of performance and neuroscience are needed. These limitations suggest that future

research should focus on the development of standardized, evidence-based, and instrument-specific programs.

METHODOLOGY

This study employs a descriptive narrative review methodology, synthesizing interdisciplinary literature from the fields of music education, performance science, sports medicine, and neuroscience. The data collection process involved searching Google Scholar, PubMed, Web of Science, and ERIC databases. The literature search utilized the keywords “musician health”, “performance physiology”, “music education and physical conditioning” and 'instrumental performance biomechanics” along with their English equivalents. The review included peer-reviewed articles, academic theses, and scientific books published between 2000 and 2025.The research adopts a comparative approach, analyzing the "musician as an athlete" paradigm to draw parallels between the training requirements of elite athletes and professional musicians. The study critically examines existing empirical data regarding:

1. The biomechanics of instrumental performance (posture, static loading, and muscle endurance).
2. Neurobiological responses to physical activity (endorphin release, neuroplasticity, and executive function).
3. Psychosocial factors in music performance (social cohesion, anxiety, and motivation). Based on this synthesis, the study develops theoretical propositions and practical recommendations for curriculum development in conservatories and music institutions.

Sports Consciousness and Benefits in Instrumentalists

It should be noted that physical activities, often overlooked during music education, are among the fundamental elements that minimize many physical problems individuals may encounter in their future professional lives. It is imperative to instill a consciousness of sports in the individual during the instrument learning phase of music education. This consciousness should be instilled in the student, particularly in the initial stages of instrument training, with an explanation of how it should become an integral part of their life.

Individuals playing an instrument adopt a distinct posture upon their bodies from the very first day of education. Regardless of the instrument, performers display various body postures, shaping themselves according to the style of the instrument they execute. Consequently, the emergence of continuously static movements exposes the body to negative effects. For example, examinations of pianists during performance have observed postural changes such as leaning and forward inclination (Wong et al., 2022: 7-10). Another study revealed a forward-leaning action in electric guitar and bass guitar players dependent on rhythmic timing (Haugen et al., 2024: 26-29). Research conducted among students at a Spanish conservatory revealed that posture quality deteriorated depending on standing and sitting performance styles (Blanco-Piñeiro et al., 2017: 330- 335).

These studies underscore the critical importance of sports for instrumentalists. The benefits arising from the establishment of sports consciousness in instrumentalists can be categorized as follows:

- Physical Endurance and Performance
- Development of Rhythm and Coordination

- Stress Management and Psychological Resilience
- Posture and Musculoskeletal Health
- Enhancement of Individual Energy Levels
- Social Connectivity and Motivation
- Mind-Body Integrity

1. Physical Endurance and Performance

Physical endurance is among the most significant issues for instrumentalists. Due to the static positioning of the musculoskeletal system during long hours of instrument practice, certain disorders may arise. It is worth reiterating that sports activities are of vital importance in eliminating this condition. The muscle strength and flexibility required during instrumental performances can be augmented through sports.

1.1. Positive Effect of Physical Activity on Muscle Strength

During the learning of any instrument, the individual is required to maintain the same posture for extended periods. During this time, specific effort levels are exerted. For instance, in guitarists, the arms may remain at the same level for hours, performing specific movements within limited boundaries. Consequently, contractions may occur in the back, shoulder, and neck regions. To mitigate this, stretching movements, weight-lifting exercises, and various combinations performed at specific intervals can prevent contractions. Effective results can be obtained by triggering different muscle adaptations through resistance training (Schoenfeld et al., 2021: 17-20). This facilitates a more comfortable progression for the individual during instrumental performance.

1.2. Effect of Physical Activity on Muscle Strength

Cardiovascular health is a crucial factor for every individual and plays a critical role for musicians. It has been observed that musicians with high physical conditioning due to sports experience a more rapid reduction in stress responses following performances and demonstrate better cardiovascular recovery (Wasley et al., 2012: 29:31). Furthermore, breath control and regular respiration are essential for wind instrumentalists and vocalists. Systematic exercises such as running and swimming can increase pulmonary capacity, providing significant facility to musicians during performance. This is beneficial not only for the respiratory system but also for cardiac health. Additionally, it has been observed that cardiovascular condition improves positively with the habituation of fitness and similar sports (Lin et al., 2015: 9-11). Considering musicians playing wind instruments, particularly in stage performances, instantaneous breathing problems can be mitigated through physical exercises. In general, it can be stated that cardio workouts can provide performance enhancement for all instrumentalists.

1.3. Flexibility and Injury Prevention

It is well known among all instrumentalists that pain can occur in different muscle groups due to excessive practice hours and maintaining the same position. In instrumentalists, muscle stiffness (rigidity) may occur, particularly in the dorsal region, due to the continuous repetition of identical movements. This can result in injuries or chronic pain (PRMDs). It would be beneficial for musicians to engage in movements providing body flexibility, such as Pilates, to alleviate this stiffness and remove fatigue resulting from overwork. Research indicates that such movements improve muscle and tendon flexibility, thereby reducing the incidence of injuries (Witvrouw et al., 2004: 448). For example, pianists' hands may remain in the same position on the keyboard for long periods, which can be felt as tension in the wrists and finger muscles. Periodic stretching exercises

can be performed to prevent this tension. Different stretching movements can be determined according to the instrument and the individual's physiology.

1.4. Energy Management in Long-Term Practice

Energy management is a highly significant issue, particularly for professional musicians. Although often overlooked, it is beneficial for every performer to comprehend energy management. Preserving one's energy can become difficult during rehearsals lasting hours in concert preparation processes. At this point, an instrumentalist who has incorporated sports into their life can increase their endurance through regular exercise. Increased endurance ensures the optimization of energy management (Holloszy & Coyle, 1984: 833). Consequently, the increase in energy levels allows them to feel better. Analogizing this to an athlete's life helps in understanding the situation; for instance, a marathon runner focuses on completing the race by regulating their energy as much as possible. The same applies to the intensive performances exhibited by instrumentalists. Physical activities ensure that the person remains at a more comfortable level during prolonged instrumental performances.

1.5. Contribution of Sports to Rest and Recovery

Instrumentalists need to rest their bodies and regenerate their muscles following intense work tempos. Sports activities can accelerate this rest and regeneration process. Through moderate walking, swimming, and meditation practices, the body can recover more rapidly. After every rigorous performance process, the body must be rested, and the individual must attend to self-care until reaching a certain level of comfort. This is also important for subsequent performance studies, preparing the individual vigorously and robustly for new musical endeavors.

2. Development of Rhythm and Coordination

Rhythm stands out as a paramount element among musical abilities. For both instrumentalists and vocalists, the connection between rhythm and the consequent coordination is a fundamental building block. The development of these elements can be augmented not only through musical talent but also through physical activities. The developmental elements emerging from these activities can be listed as follows:

2.1. Development of Motor Skills and Rhythm Connection

Motor skill formation can be expressed as the provision of conscious and systematic control exhibited by individuals depending on body movements. It is known that Rhythmic Auditory Stimulation (RAS) improves motor synchronization and enhances stability focus regarding balance (Wang et al., 2022: 8). In the context of music education, rhythm exercises (on the instrument) can activate the motor skill perception formed in the brain. Rhythm skills acquired by individuals have positively affected both timing and executive brain functions (Ahokas et al., 2025: 11). Rhythm exercises activate the timing and synchronization connection in the brain. The importance of sports manifests here, as it supports the strengthening of balance and coordination through necessary body exercises. Sports can specifically support the rapid coordination formed between the hand and brain in instrumentalists. Establishing a daily routine of physical activities within a specific plan is meaningful here. Just as technical exercises for the instrument are performed without interruption daily, sports should be habituated within the same order to contribute to the individual.

2.2. Effects on Hand-Eye Coordination

Hand-eye unity (congruence) is important for instrumentalists. For example, deciphering the notation of a song or instrumental piece while simultaneously accompanying it with the instrument requires rapid hand-eye coordination. This can be supported by physical activities. In certain sports branches, exercises highlighting eye and reflex coordination can provide these elements as extra gains. Engaging in sports that involve sudden decision-making, and rapid reaction can constitute a supportive factor for instrumental performance.

2.3. Cognitive and Physical Harmony Dynamics

Music and sports appear as two disciplines harboring cognitive and physical harmony. Physical exercises maximize not only physical strengthening but also cognitive harmony. Thus, they facilitate the development of attention, rhythmic structure, and control mechanisms required in a musician (Ratey & Loehr, 2011: 171). When these connections are noted, the importance of sports for individuals receiving music education becomes evident. While the brain's different operating system develops during instrument learning, the physical harmony emerging positively in the individual through the implementation of sports activities is of great importance. Therefore, both the cognitive and physical harmony of instrumentalists and those engaged in other areas of music education can be supported by sports to reveal faster development.

2.4. *Rhythm Training and Instrument Performance*

Rhythm training within sports can be a supportive element for instrumentalists. For instance, in collective sports activities, individuals performing the same movements together and the synchronized movements between them increase rhythm capabilities. Through the rhythm construct gained via sports, it is possible for the mastery over the instrument to increase positively. Reinforcing the brain's rhythmic structure with sports and carrying this to the musical dimension can support the rhythm (metronome) system applied on the instrument. Timing and synchronous integrity are essential for all instrumentalists. Therefore, emphasizing rhythm training within sports activities is thought to be beneficial as a supportive element for instrumental performances.

3. Stress Management and Psychological Resilience

Perception of stress is a condition generally seen in most individuals engaged with music, underlying which are numerous causes. Even in professional and highly educated musicians, stress factors such as rapid breathing, increased heart rate, and tremors occur (Yoshie et al., 2009: 121). The crucial aspect is to cope with these negative elements and maximize instrumental performance. Another area where stress is distinctly felt is performances exhibited before an audience. Here, musicians' stress levels rise with the perception that their identities and talents are under threat (Papageorgi et al., 2011: 37). This stress factor, commonly known as Music Performance Anxiety (MPA), is prevalent among most instrumentalists. To overcome this, long hours of individual music practice are required. Although these studies on the instrument protect performers from stress to a certain level, establishing a complete balance can take considerable time. To use this time more efficiently and effectively, integrating sports into life is important. Through the endorphin release resulting from sports, individuals can feel psychologically more robust. Consequently, performance anxiety can be brought to a tolerable level.

3.1. *Effects on Stress Hormones*

Fears such as "what if I can't do it, what if I can't play, what if I play a wrong note" may arise during instrumental performances. These are among the fears and thoughts experienced by every

musician. This situation, especially emerging in individual and public performances, triggers stress hormones. Sports are a significant factor in preventing this and controlling it at a minimum level. Through regular exercises, balancing the stress hormones in the body can provide instrumentalists with an effective way to cope with stress (Hamer et al., 2006: 186). In other words, the rapid activation of the auto-control system without activating stress hormones is an element that should be present in most musicians.

3.2. *Endorphin Release and Formation of Positive Thought*

When the connection between instrumentalists and sports is considered, it can be stated that the development of the thought system lies among the most important details. This can be supported by sports. Endorphins released in the body as a result of physical activities act as natural analgesics. Thus, negative thoughts emerging during intense instrumental performances can be suppressed, providing positive emotion. Furthermore, it is important to eliminate the feeling of stress and tolerate mental fatigue. Regular sports and the accompanying endorphin secretion will present a positive mood (Dishman et al., 2006: 348). This mood is a characteristic that should be acquired, especially for instrumentalists.

3.3. *Flow Experience in Music and the Effect of Sports*

Due to intense work and hours of instrument exercises, musicians may feel that time passes quickly. This sensation is related to the performer's extreme focus, causing them to forget the concept of time at that moment, known as the "flow state." This experience also emerges while doing sports. It would not be incorrect to state how interconnected sports and music are. The flow experience gained during physical activities can help eliminate negative thoughts called "mental blocks," assisting in exhibiting a more flawless performance during instrumental execution (Csikszentmihalyi, 1990: 63-64). The mental block element is generally viewed as negative for musicians. Therefore, it is appropriate to say that eliminating this negative situation involves gaining sports habits.

3.4. *Team Sports and Socialization*

Individuals engaged with music, particularly instrumentalists, generally work alone. This causes them to face the phenomenon of social isolation from time to time. This social isolation can increase stress and anxiety levels in the musician. To overcome this, sports performed with a community can defeat the loneliness syndrome. Positive interactions provided within a community through sports activities will help erode the loneliness arising from hours of dealing with music. On the other hand, by strengthening musicians' emotional resilience, it can enable them to cope with the stress perception that sometimes arises during instrumental performance (Baumeister & Leary, 1995: 506).

4. Posture and Muscle Health

Posture and muscle integrity are among the most important topics concerning all individuals engaged with music. In instrumentalists, who are the main scope of our research, this issue constitutes a distinct importance. Whether during instrument learning or professional performances, postural disorders and muscle pains resulting from standing or sitting fixed for long periods can manifest. To remedy these pains and postural disorders, recourse to physical activities is necessary.

4.1. Postural Problems in Instrumentalists and the Positive Side of Sports

During instrument learning and performance, musicians carry out technical studies by remaining in the same position for long hours. Consequently, they become vulnerable to postural disorders. Muscle imbalances and, in the long term, chronic pains may manifest as a result of instrumental performance in the same position. Sports exercises are significant for eliminating this situation. Physical movements aimed at stretching, such as Pilates and yoga, will protect the postural structure and ensure the formation of more relaxed muscle structures. Improvements in musicians' individual performances are also observed thanks to sports activities that help stabilize posture (Klein-Vogelbach, 1990: 22-23). Postural problems, frequently seen in instrumentalists, cause serious and chronic ailments in later ages if precautions are not taken. Therefore, professional studies on the importance of sports and how to integrate them into life starting from the first years of music education are important.

4.2. Physical Activity in Musculoskeletal System Development

The robustness of the musculoskeletal system is among the body elements that must be active in individuals dealing with instruments. During continuous instrument education and learning, there is excessive loading on the skeletal system. When static posture is added to this, stiffness and pains in the muscles may emerge. Through sports movements, these pains and muscle stiffness can be minimized. For this, sports activities containing resistance and flexibility movements should be performed. These movements enable instrumentalists to exhibit long-term performances and use their musculoskeletal systems more actively (Falla et al., 2007: 413). Playing an instrument is not only a musical act but also a set of movements where we use our body as a whole. Therefore, it is important for musician individuals to strive to protect their musculoskeletal systems.

4.3. Muscle Tension During Instrumental Performance and Sports Connection

Stress injuries can emerge in instrumentalists who excessively use fingers, wrists, and shoulder regions. Stress injuries generally manifest because of overuse of muscles and excessive loading. The importance of sports in this situation is again noteworthy. Research on music students shows that sports (warm-up exercises) minimize muscle tension and stiffness, demonstrating a relaxing effect on individuals engaged with music (Austen et al., 2024: 5-6). Therefore, it is beneficial for musicians to reduce muscle tension and engage in sports activities directed at this.

4.4. The Effect of Posture on Instrumental Performance

Among sports movements “posture-focused” activities are particularly important for instrumentalists. Having a good posture harbors a structure containing “self-confidence” in stage performances. Involuntary postural disorders during practice are a negative element. For the elimination of this negative situation the correctness of posture and the importance of sports in this direction play a critical role.

5. Concentration and Focus

Musical performances generally require high levels of concentration and focus. These elements are even more critical when instrumental performance is considered. The reasons include the complex structures created by brain functions performing multiple tasks simultaneously. The brain-body unity trying to perform many different tasks during instrumental performance requires a high degree of focus. Any negative element occurring during this focus process can lead to errors. To minimize these errors, engaging in sports activities is important. Research reveals that anxiety levels are generally lower in musicians who engage in regular physical activities (Spahn et al.,

2016: 4-5). Sports activities play a critical role not only during music learning but also for professional performance. It is necessary to implement the supportive side of sports to eliminate unwanted elements such as stage fright, excitement, fear of making mistakes and loss of focus.

5.1. Mental Focus and Aerobic Exercises

Aerobic exercises, which have an important place in sports activities, increase the amount of oxygen going to the brain, enabling the individual to become mentally more focused. Considering that regular walking, running, and cycling have a positive effect on brain functions, it is undeniable how beneficial they are for musicians. Research has observed that aerobic exercises have positive effects on attention and focus, alongside increases in musical performance levels (Colcombe & Kramer, 2003: 128).

5.2. Meditation and Mental Relaxation

The stage is among the most important performance venues for instrumentalists. Consequently, stress-related pressure can occur in musicians during stage performances, reflecting negatively on the execution. To escape such handicaps, mental relaxation can be sought through meditation. Some studies have shown that meditation performed for tasks requiring excessive attention raises performance to higher levels (Lutz et al., 2008: 164). Due to the necessity of extreme attention in instrumental performance, individuals can resort to self-relaxation through meditation.

5.3. Sports Activities for Attention Management in Instrument Players

Attention management occupies an important place among the basic cognitive traits required for musical performance. Team sports can be considered to instill the phenomenon of attention management in musician individuals. Attention management skills can be formed in the individual by participating in team sports and performing them with full focus. This skill enables instrumentalists to be more effective in orchestras or group musical performances.

5.4. Minimizing Fatigue Levels

Fatigue symptoms appear as a result of excessive work during instrument learning and performance. This fatigue lowers instrumental performance while also negatively affecting the sense of focus. However, it is possible to minimize these negative elements through sports. Research has shown that endurance-requiring performances also increase due to the high energy generated by sports (O'Connor & Puetz, 2005: 7).

5.5. Effect on Brain Functions

The complex thought system is highly important in individuals dealing with music. Through this system, many different functions are executed within milliseconds in line with signals from the brain, especially in instrumentalists. These signals must be formed flawlessly. Regular sports exercises are important for the brain to perform these functions more stably and accurately. Regular exercise supports the development of attention and memory. A significant study reported that regular sports increased brain volume (hippocampus), resulting in the development of mental functions (Erickson et al., 2011: 3019).

6. Social Connectivity and Motivation

Social connections are among the most important building blocks of progressing on the musician's path, followed by motivation. These two interconnected elements also manifest as parts of personal development for musicians. Although individual practice is generally a solitary act, it is accurate

to state that strong social connections and high motivation lie at the foundation of being a successful performer. Sports features such as team spirit and intragroup motivation are important for the success musicians will exhibit in both individual and collective performances.

6.1. *Relationship Between Team Sports and Social Connections*

Team sports are among the systematic structures allowing the strengthening of social connections. People working in the music field are generally compelled to work alone (etudes, repertoire study, etc.). This can sometimes lead to asociality and difficulties in establishing social connections. However, performing collective activities like team sports enables musician individuals to interact with different social groups. These interactions pave the way for establishing strong friendship bonds in musical environments as well (Baumeister & Leary, 1995: 500/522).

6.2. *Group Dynamics and Teamwork Systematics*

Teamwork skills emerging from team sports enable the desired harmony within musical ensembles. For an instrumentalist, being successful in an orchestra or any music ensemble is essential. The discipline applied in team sports is critical in this regard. Group systematics developed through sports activities assist in being more compatible in musical projects and adopting effective working principles. Academic studies have shown that individuals developing themselves in team sports show improvement in cooperation and communication skills, providing a positive contribution to music groups (Carron et al., 2002: 180). Such habits must be instilled in institutions providing music education, such as conservatories.

6.3. *Motivation and Effect Level in Goal Setting*

Physical activities generally have a positive level of influence on motivation. The impact level of sports is considerably high in directing towards distinct goals and overcoming focus problems in instrumentalists. To establish a construct of discipline, determination, and motivation, musician individuals should engage in sports as much as possible. Research has seen that focus and motivation processes occur faster in individuals interested in sports (Ryan & Deci, 2000: 71).

6.4. *Social Support and Sports in the Context of Group Sports*

Sports provide social support to the individual. When evaluated in terms of instrumentalists, this support can help overcome difficulties encountered in musical performances. Generally, musicians feel stress and pressure when exhibiting any performance. Support can be drawn from the application of group sports activities to eliminate this situation. The resulting socialization and support facilitate coping with stress. Studies have observed that such activities providing social support help dampen stress in individuals (Cohen & Wills, 1985: 310).

6.5. *Harmony of Music and Competitive Spirit with Sport*

The act of improving is always present in the nature of sports. Although this action varies with the type of sport, the desire to achieve something exists fundamentally. Within this perspective, this element is of critical importance for musicians wanting to be successful in their careers. The determination to reach success will be triggered by integrating the balance existing within the competition system of sports into their musical lives. This situation will manifest as a great source of motivation in musicians. Individual sports are important for musicians to always take their talents and performance levels one step further (Hodge et al., 2013: 130).

7. Mind-Body Integrity

The two most important elements an individual should possess throughout their life are mental and physical integrity. The harmony between both mental and physical health is crucial. This harmony between mind and body forms the basis for a person's overall health. The more an individual makes a healthy lifestyle a part of their daily routine, the more they will be able to maintain mental and physical integrity (Dilfuza, 2023: 3-4). In this context, this harmony also has implications for the relationship between sports and music. The presence of sports activities in a musician's life is a hidden force that helps them maintain mental and physical integrity. Furthermore, to maintain stable brain functions, routine sports activities should be integrated into daily musical studies. These added and regular sports activities will both protect the physical health of musicians and provide mental support. The endorphins released during exercise also lead to a general mental relaxation. This relaxation will help minimize stress, a major enemy for musicians (Wallic et al., 2020: 38-42). It's helpful to consider the relationship between sports and music mentioned here as intertwined. In fact, it's not just musicians who benefit; the combination of sports and music also benefits individuals in any profession. Studies on this topic have shown that the combination of sports and music optimizes both mental and physical health (Martín-Rodríguez et al., 2024: 6). This suggests that constant music playing in gyms is actually a benefit of this harmony. Considering the importance of mental and physical balance in individuals' overall health, the positive contribution of the music-sports combination plays a significant role in this.

FINDINGS

Based on an extensive review of literature and theoretical analysis, this study categorizes the impact of physical activity on instrumentalists into seven primary domains. This study presents a multifaceted body of evidence confirming that systematic physical training is a critical intervention for holistic musical development. Synthesizing insights from sports medicine, music psychology, and neuroscience, we demonstrate that sports engagement offers more than just physical fitness; it fundamentally improves the biomechanical and neurocognitive foundations of high-level performance. The results indicate that physical conditioning functions both as a preventative mechanism against Playing-Related Musculoskeletal Disorders (PRMDs) and as a catalyst for better executive function and emotional regulation. Crucially, the data reveals that the physiological adaptations gained through sports (e.g., cardiovascular endurance, core stability) are functionally transferable to the demands of instrumental technique, effectively bridging the gap between “athletic” preparation and “artistic” execution. Finally, the observed impacts of physical activity are categorized into seven primary domains, elucidating the complex interplay between physiological resilience, sensorimotor integration, and psychosocial well-being.

These findings synthesize the physiological, neurocognitive, and psychosocial evidences presented in the preceding sections:

1. Findings regarding Physiological Endurance and Musculoskeletal Integrity

Evidence confirms that the static loading and repetitive fine motor demands intrinsic to instrumental performance significantly exacerbate the risk of neuromuscular fatigue and Playing-Related Musculoskeletal Disorders (PRMDs). Resistance training and flexibility protocols specifically Pilates and yoga function as essential prophylactic mechanisms by normalizing muscle tone and rectifying postural asymmetries. Furthermore, the data indicates that augmented aerobic capacity optimizes metabolic efficiency, thereby elevating the fatigue threshold and sustaining physical output during high-demand artistic engagements.

2. Findings on Neurocognitive and Psychomotor Development

Analysis of the literature reveals that sports “activities / particularly” those requiring hand-eye coordination and rapid reflex “responses / contribute” to the refinement of sensorimotor integration in musicians. Evidence supports that rhythm-based physical activities stimulate the brain's temporal processing mechanisms, resulting in a direct transfer of skills that enhances rhythmic precision, timing accuracy, and psychomotor control on the instrument.

3. Findings concerning Stress Management and Music Performance Anxiety (MPA)

It has been found that the neurochemical response to physical exercise, specifically the upregulation of endorphins and dopamine, plays a regulatory role in mitigating the somatic symptoms of Music Performance Anxiety (MPA), such as tremors, tachycardia, and hyperventilation. The findings suggest that the physiological regulation provided by regular sports practice fosters psychological resilience, allowing instrumentalists to maintain performance stability under pressure.

4. Findings regarding Postural Ergonomics and Injury Prevention

The study identifies that instrument-specific asymmetric stances often lead to maladaptive postural habits. Findings demonstrate that core-strengthening and posture-focused exercises are effective interventions for restoring neutral spinal alignment and enhancing postural stability. This stabilization is found to be critical in preventing chronic pain syndromes associated with the "static-dynamic" conflict of instrumental performance.

5. Findings on Attentional Control and Executive Functions

Evidence indicates that regular aerobic exercise enhances cerebral oxygenation, which supports executive functions such as sustained attention, working memory, and inhibitory control. It has been observed that musicians who engage in physical conditioning exhibit a greater capacity to maintain concentration during intensive practice sessions and show a reduced incidence of "mental blocks" or cognitive fatigue.

6. Findings regarding Psychosocial Well-being and Group Dynamics

The review establishes that participation in team sports serves as a significant psychosocial buffer against the social isolation often necessitated by solitary practice routines. The findings highlight that skills acquired in team sports—such as non-verbal communication, group cohesion, and collective goal-setting—are transferable to musical ensembles, thereby enhancing ensemble cohesion and interpersonal synchrony within orchestras and chamber groups.

7. Findings on Mind-Body Integrity and Emotional Regulation

It has been determined that physical activity enhances the instrumentalist's capacity for emotional regulation, ensuring that musical expression is supported by a stable physiological state. The findings suggest that the "flow state" experienced during immersion in sports shares neural substrates with optimal musical performance, and that physically active musicians are more likely to achieve and sustain this state of "mind-body integrity" during performance, resulting in heightened artistic expressivity.

DISCUSSION

The findings of this study reveal the positive effects of regular athletic activities on instrumentalists in terms of musculoskeletal health, correct posture, endurance, and stress management. This finding is significantly consistent with existing international literature. The finding that "muscle

tension and incorrect posture caused by long hours of fixed posture can be mitigated by disciplined exercise (sports activities)" is consistent with systematic studies on musculoskeletal disorders (PRMD) caused by incorrect posture in professional instrumentalists (Rotter et al., 2019: 215; Zaza, 1998: 1023). These studies generally emphasize the importance of exercise programs and their positive rehabilitative effects. Some empirical studies on musicians have demonstrated the positive effects of athletic activities (exercises). A significant study in this regard found that after eight weeks of athletic activity, most musicians experienced improved posture, alleviated pain during musical performance, and experienced positive improvements in their overall lifestyle (Chan et al., 2014: 6-7). Another study conducted along the same lines found that improved physical fitness in musicians leads to greater long-term injury resistance (Hoppman and Patrone, 1989: 51). Considering these findings, they support the idea that the athletic activities we presented in this study (Pilates, yoga, stretching, etc.) should be integrated into the curricula of both conservatory education and other music institutions. Furthermore, existing research on this topic is generally based on small sample sizes and short-term follow-up. Large-scale randomized controlled trials are needed to further measure and demonstrate the impact of these exercises.

Some neuroscience studies suggest that resistance exercises can increase both focus and positively impact the brain. A detailed study reported a positive increase in brain (hippocampus) volume and positive development in brain memory functioning, particularly through aerobic exercise (Erickson et al., 2011: 3019). The aforementioned findings indicate that athletic activity positively impacts not only the individual's peripheral systems but also the central nervous system. This provides a biological basis for the positive effects of athletic exercise on musical focus and the endorphin (flow) system, the focus of our current study.

As seen in the research there are some gaps in the literature. In particular, determining the risks associated with each instrument (wind, string, percussion, keyboard, etc.) poses a critical challenge for instrumentalists. There is a need to determine the athletic exercise processes of musicians who use different instruments, and to establish objective criteria. These criteria should be applied and calculated medically. For example: There is a need to study the effects of neurosignals obtained from the pupil using EMG (electromyography), HRV (heart rate change) measurement, or pupillometry (pupil-opmetry) on instrumental performers. Given these methodological limitations, new studies are needed that bring together the disciplines of performance and neuroscience in a collaborative study (Vorkapic et al., 2021: 548-550).

Performance anxiety (MPA) is a significant psychological condition that is frequently encountered by musicians, especially instrumentalists. Various studies have shown that regular exercise and mental focus (yoga, breathing exercises, meditation, etc.) contribute to a reduction in anxiety symptoms and a more regulated mood (Makizako et al., 2014: 13). However, the duration, intensity, and timeframe of these athletic activities remain uncertain. Therefore, it is crucial to implement well-defined exercise programs based on scientific evidence in conservatories and professional choirs. In this way, instrumentalists can be made more resilient both physically and psychologically.

CONCLUSION

Engaging in sports for the instrumentalists discussed in this research possesses critical importance not only for providing physical comfort but also for sustaining their professional lives healthily. A positive parallelism is established between the acquisition of sports habits and the enhancement of stage performances, individual etudes, mental endurance, and technical efficiency. Instrumental performance falls within professions requiring isometric muscle use over long periods, respiratory coordination, and punctuality (rapid reflex) under cognitive load. Within these characteristics, an

instrumentalist can be defined as a micro-scale athlete. Therefore, they are in constant development regarding repetitive fine movements, endurance, emotional reactions, and postural stability. Regularly structured physical activities specific to each instrumentalist reduce muscle imbalances and strengthen body stability. On the other hand, physical fatigue during performance is minimized thanks to the increase in cardiorespiratory capacity. This contributes to technical proficiency (on the instrument) by increasing performance and learning capacity. Specific to this proficiency issue, the two-way "Peripheral/Central" contribution is directly compatible with the literature regarding minimizing clinical (PRMD) findings and maximizing neurocognitive performance.

Other main effects of sports on the performer act as fundamental components in psychological strengthening and stage performances. Thanks to the endorphin increase emerging with physical activities, attention and mood components important for instrumentalists show improvement. In this context, while the anxiety rate emerging during performance decreases, relief is provided in terms of mental flexibility. These emerging systems improve not only posture or pain but also motivation, stage fright, and group work performances in instrumentalists regularly exercising. As a result of this improvement, positive outcomes occur in social and psychological senses.

Specifically in conservatories and music education institutions, physical activities should be added to the curriculum not only for music education but also for the protection and strengthening of bodily integrity. As an implementation proposal to be included in the curriculum; daily warm-up routines of approximately 30 minutes for each instrument group, weekly two or three sessions of stretching-strength programs, physiological (breath, cardio) movements before concerts, and areas for Pilates (yoga, etc.) should be created in places where music education is provided. These practices included in the curriculum should be evaluated with posture analysis, EMG, and respiratory tests. Thus, the enhancement of performance in instrumentalists and the prevention of occupational injuries will be ensured. Physical activities possess a critical value in terms of both the welfare level of instrumentalists and the sustainable continuation of musical production processes.

RECOMMENDATIONS

1. *Curricular Integration*: Making "Musician Health and Physiology" courses mandatory. These courses should be practical rather than theoretical (body mapping, basic strength training, stretching techniques).
2. *Early Screening*: Screening students for physical risk factors (hypermobility, poor posture, muscle weakness) at the conservatory entrance stage and developing individualized exercise prescriptions accordingly.
3. *Specialty-Specific Conditioning:* Specialized sports programs tailored to the needs of each instrument. (E.g., Pilates to correct asymmetry for strings; swimming to increase cardiovascular capacity for wind players; forearm endurance and back strength exercises for pianists)

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GENİŞLETİLMİŞ ÖZET

GİRİŞ

İster profesyonel ister kişisel zevk için olsun, müzik aleti çalan herkes için fiziksel aktivite çok önemlidir. Vücudu hareket ettirmek hem fiziksel hem de zihinsel sağlığı destekleyerek müzik pratiğini daha sağlıklı ve uzun vadede sürdürülebilir hale getirir. Sanatsal çalışma (çalgı

performansı) ile fiziksel aktivite arasında denge kurmak, zihinsel berraklığı ve genel sağlığı korumaya yardımcı olmaktadır. Genel olarak bakıldığında bir çalgı icra etmek sadece sanatsal bir eylem değil aynı zamanda odaklanma, koordinasyon ve zihin ile beden arasında güçlü bir bağlantı gerektiren karmaşık bir süreçtir. Bu tür karmaşık aktiviteler, vücudun sürekli zihinsel baskı altında yüksek hassasiyetli bir makine gibi çalışmasını gerektirir. Bundan dolayı çalgı icra eden bireyler tarafından fiziksel hareketler gerçekleştirilirken, bu aktiviteler paradoksal olarak bazı kas gruplarında hareketsizliğe de neden olabilmektedir. Bazı kaslar aşırı kullanılırken, diğerleri statik kalabilir. Bu durum ise önemli duruş bozukluklarına ve kan dolaşımının azalmasına yol açar. Bunu göz önünde bulundurarak, özellikle çalgı icrası sırasında ortaya çıkan "Kas İskelet Sistemi Bozuklukları (PRMD)" gibi çeşitli fiziksel rahatsızlıkları tetikleyebilir. Bu sorunlar, kronik iltihaplanma, sinir sıkışması veya sürekli kas yorgunluğu şeklinde kendini gösterebilir. İşte tam bu noktada sporun önemi ortaya çıkmaktadır. Sistematik egzersiz, müzisyenin fiziksel sağlığını ve profesyonel kariyerini korumak için gerekli bir düzeltici mekanizma sağlar. Müzik aleti icra eden bireyler için spor yapmak sadece fiziksel zindeliği artırmakla kalmaz aynı zamanda daha güçlü bir zihinsel sistemin gelişmesine de katkıda bulunur. Bu gelişim sayesinde özellikle çalgı performans kaygısını ve odaklanmayı yönetmek için faydalı olmaktadır. Çünkü fiziksel disiplin doğrudan bilişsel dayanıklılığa dönüşmektedir. Bu nedenle gelişmiş duygusal düzenleme yoluyla kendini ifade etmeyi geliştirmek için hayati önem taşır. Psikolojik istikrarın ötesinde, hareketin fizyolojik faydaları, teknik ustalığın doğasında bulunan tekrarlayan gerilimi dengeler. Fiziksel aktivite gibi planlı atletik (sportif) aktiviteler, kas-iskelet bütünlüğünü korur ve uzun süreli, hareketsiz enstrüman çalmanın neden olduğu gerginliği azaltarak lokalize ağrıyı en aza indirebilir. Kardiyovasküler sağlığın entegrasyonu, karmaşık ifadeler için gerekli olan ince motor becerilerini destekleyen biyolojik bir temel sağlar. Fiziksel dayanıklılık ve sanatsal duyarlılık arasındaki boşluğu kapatmak, müzisyenlerin daha tutarlı bir akış elde etmelerini sağlar. Çalgı icra edenler, düzenli bir egzersiz rejimi benimsediklerinde, genel yaşam kalitelerinde ve enerji seviyelerinde önemli iyileşmeler görülür. Bu bütüncül yaklaşımla birlikte elit performansın zorlu gereksinimlerinin tükenmişliğe yol açmamasını sağlayarak, profesyonel sanatçının kalıcı yaratıcı enerjisini koruyabilecektir. Bu bağlamda yoğun çalgı performansın etkinliğinin optimize edilmesi, genel performans kalitesini de iyileştirebilir. Dolayısıyla sürekli hareket halinde olan sağlıklı bir vücut, daha duyarlı bir kanal görevi görür. Fizyolojik faydaların ötesinde atletik aktivitelerin stresi azaltma, konsantrasyonu artırma ve dikkat süresini iyileştirme gibi önemli psikolojik faydalar sağladığı da gözlemlenmiştir. Egzersizden kaynaklanan endorfin salınımı sayesinde bireyde iyilik ve rahatlama durumu ortaya çıkmakla birlikte daha sakin bir durum meydana gelmektedir. Ayrıca çalgı performansı sırasında tatmin edici bir performans deneyimi de kendini göstermektedir. Diğer yandan egzersiz alışkanlıklarının kazanımı sayesinde, topluluk ortamlarında sosyalleşmeyi ve iletişim becerileri daha kolay hale gelmektedir. Böylelikle sosyal sistem içinde grup uyumunu destekleyerek kültürlerarası müzikal etkileşimi de teşvik etmektedir.

Bu çalışma kapsamında çalgı performansıyla ilişkili mesleki sağlık risklerini azaltmada sistematik fiziksel aktivitenin kritik rolün, detaylandırılarak aydınlatılması hedeflenmektedir. Profesyonel çalgı performansı geleneksel müzik eğitimi müfredatlarında genellikle hafife alınarak önemli fizyolojik ve psikolojik talepleri beraberinde getirmektedir. Çalgı performansı sırasında statik ve asimetrik duruşlar genellikle uzun süreler boyunca korunur. Bununla birlikte yüksek bilişsel yük altında tekrarlayan, ince motor hareketlerin gerçekleştirilmesi gerekliliği, müzisyenleri performansla ilgili kas-iskelet bozukluklarına (PRMD) yatkın hale getirebilir ve çeşitli olumsuz etkilere (kas sertliği, kronik ağrı, duruş bozukluğu vb.) yol açabilir. Ayrıca, müzisyenlerin yaşadığı yoğun performans baskısı (mükemmeliyetçilik), Müzik Performans Kaygısı (MPA) gibi psikolojik zorluklara yol açabilir. Bu risklere rağmen sistematik fiziksel kondisyonun müzik eğitimine

entegrasyonu son derece yetersiz kalmaktadır. Bu çalışma genelinde müzik eğitimi, performans bilimi, spor hekimliği ve nörobilimden disiplinlerarası literatürü sentezleyen tanımlayıcı bir anlatı inceleme metodolojisi kullanmaktadır. Ortaya konan bulgular ışığında, sistematik fiziksel eğitimin bütünsel müzikal gelişim için kritik bir müdahale olduğunu doğrulamaktadır. Atletik aktivitelere katılmanın sadece fiziksel zindeliği artırmakla kalmayıp, aynı zamanda biyomekaniği de temelden iyileştirdiği gözlemlenmiştir.