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Effects of a music-based exercise program on the postural balance and emotions of instrumentalists

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This study aimed to verify the effects of a music-based exercise program on postural balance and emotional factors among instrumentalists. We recruited 11 instrumentalists aged 25–45 years who were asked to perform a music-based exercise program for 60 min per session, three sessions weekly, for 8 weeks. The anterior balance and lateral alignment of the participants were determined using a body posture analyzer. To assess the emotional factors, the World Health Organization Quality of Life, stress response inventory, and Rosenberg self-esteem scale were used. This study did not reveal a statistically significant difference in anterior postural imbalance and lateral misalignment. In contrast, emotional factors, including quality of life, stress response, and the self-esteem subcategories, exhibited significant differences. The music-based exercise program in this study significantly improved the emotional factors. Nevertheless, a more structured and long-term program should be developed to ensure the improvement of postural imbalance among instrumentalists.

Keywords: Instrumentalist, Music-based exercise program, Posture balance, Quality of life, Self-esteem

INTRODUCTION

Instrumentalists express themselves through their artistic talent and virtuosity during long hours of playing music. Consequently, the manner in which they use their body during a performance has a direct impact on the quality of the performance. Controlled movements are essential when playing musical instruments, which consequently lead to nonoptimal asymmetric postures (Blanco-Piñeiro et al., 2015). The repeated use of certain joints and muscles and asymmetric utilization of the body with biased use of the hands, arms, and shoulders can cause musculoskeletal disorders and postural imbalance among many instrumentalists. Instrumentalists practice and play music with repetitive motions and postures; consequently, approximately 70%–80% of instrumentalists experience playing-related pain or musculoskeletal disorders (PRMDs) (Ackermann et al., 2014; Kenny and Ackermann, 2015; Lamontagne and Bélanger, 2015). In terms of psychological health, instrumentalists are more prone to anxiety, stress, and depression. Moreover, various studies have reported that 16%–55% of instrumentalists and undergraduates have music performance anxiety (MPA) (Gómez-López and Sánchez-Cabrero, 2023; Lamontagne and Bélanger, 2015). MPA has a negative effect on psychological health through the increase in levels of anxiety and depression. Therefore, overcoming MPA among instrumentalists is critical, not only for music-related factors that enhance the quality of the performance but also for the physical and psychological health benefits.

When experiencing PRMDs or psychological problems, many instrumentalists tend to reduce their practice time or evade performance engagements (Stanhope et al., 2014). Studies on PRMDs have so far focused mainly on the statistical analysis of pain-related characteristics of playing instruments and psychological pain in instrumentalists, while very few studies have explored the risk of occupational injury (Nair et al., 2023). The errors in the treatment of joint injury in instrumentalists may result from the use of a conventional treatment method that does not take into account

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the unique characteristics of instrumentalists with overuse syndrome (Rickert et al., 2012; Wilke et al., 2011). The conventional method of exercise-based treatment can alleviate pain, enhance muscle endurance and strength, and reduce stress, but it is inadequate to prevent PRMDs (Rethorst et al., 2009; Wajswelner et al., 2012). In light of this, a well-designed stretching or exercise program may serve as a nonpharmacological therapy for instrumentalists to resolve such problems (Kava et al., 2010).

Rhythmics in music-based exercise programs are likely to be a favorable strategy that reflects the concept of "somatics" and inner perceptions of physical balance and psychological stability. Somatics is concerned with first-person perspective motion, so it refers to all physical techniques that create changes inside the body. It has recently been introduced as movement therapy in several studies as part of the treatment of the body and mind (Phuphanich et al., 2020). The exercise program based on the concept of somatics in this study is thus presumed to be a good program that can incorporate psychological stability and physical balance perceived from inside the body of the participants. In rhythmics, sound and music are created through movements, and movements are created through music. The program used in this study was based on rhythmics to enable participants to express their inner selves through movements. The program was designed to arouse a natural sense of rhythm among participants, with the rhythm of music as the medium rather than artificial rhythm. A recent study by Ryu et al. (2023) reported low exercise intensity in their rhythmics program with the maximal heart rate at 62.85% and the rating of perceived exertion at 12.22. Such low-intensity exercise programs are thought to be a good method to simultaneously promote psychological stability and the positive effects of rhythm-based exercise. It is important to verify the effects of understanding movement based on music, which is a familiar medium for instrumentalists, in terms of postural correction and emotional alterations that interact in daily life. This study aimed to investigate the effects of a novel music-based exercise program on the postural balance, quality of life, stress response, and self-esteem of instrumentalists.

MATERIALS AND METHODS

Research participants

The participants in this study were 11 female instrumentalists aged 25–45 years, and a preliminary survey was conducted to select eligible participants. The inclusion criteria were individuals with no history of surgical operation within the past 6 months, no current regular exercise, no specific disease, and the ability to participate in an 8-week program. The exclusion criteria were individuals with a specific disease, including serious conditions from stroke and myocardial infarction to cancer, and any type of musculoskeletal disease that prevents participation in exercise. All participants were provided adequate explanations on the contents and purpose of the study, and written consent was obtained from the participants. The experimental procedure was approved by the appropriate institutional ethics committee (INJE 2021-02-007-002). Table 1 shows the characteristics of the study participants.

Table 1. Physical characteristics of the participants (n=11)

Characteristic	Value
Age (yr)	34.00±8.69
Height (cm)	161.23±4.45
Weight (kg)	56.35±4.62
Body mass index (kg/m^2)	21.68±2.05
Body fat (%)	27.06±2.05

Values are presented as mean±standard deviation.

Music-based exercise program

The music-based exercise program in this study was administered for 60 min per session, with three sessions per week, for 8 weeks. The program consisted of a warm-up, main exercise, and cool-down. Based on rhythmics, low intensity movements constituted the exercise (Table 2).

Body composition

An automatic scale (BSM330, Inbody, Seoul, Korea) was used to measure the height (cm) and weight (kg) of the participants, after which, their body mass index was calculated. The percent body fat was measured using a body composition analyzer (Inbody 720, Inbody).

Postural balance test

To examine the changes in physical balance and posture, a multidimensional test on musculoskeletal imbalance and misalignment was performed using a body posture analyzer (Exbody 770, Exbody, Seoul, Korea). The test accuracy was enhanced by attaching a marker to a target site identified by palpation for subsequent digital imaging and analysis.

Quality of life

The World Health Organization Quality of Life scale was used for scientific and comprehensive assessments. The tool consists of 26 items across four domains: physical health, psychological health,

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Table 2. Music-based exercise program

Category	Motion	Description
Warm up (5 min)	Walking control	Walking with postural alignment based on gravity and center of weight
Main exercise (50 min)		
Rhythm /Music	Improvisation	Improvising movements in accordance with the music-related factors of improvised instrumental sounds (rhythm, melody, volume, and speed)
	Break beat	Walking on rhythm within a given set of beats, creating free movements
Voice/Sound	Voice	Hearing a song and expressing the emotion as vocal sounds and movements
	Speech	Hearing a word and expressing the image as movements, creating one's own story, and linking it with movements
Follow movement	Fingers fullness	Moving along the music with the fingertips placed on a small ball, in a team of two; a leader and a follower (both the leader and follower or only the follower should close their eyes during the expression)
	Floor dance	Widening the range of motion: Drawing movements by limiting a part of the body (an arm, a leg, etc.)
Cool down (5 min)	Breath control meditation	Walking with postural alignment, meditating, sharing emotion through conversation

Table 3. Changes in postural balance after the 8-week exercise program

Variable	Pre	Post	Δ Score	*P*-value
Anterior analysis				
Body inclination	17.91±5.52	17.09±7.56	-0.82±1.85	0.667
Head inclination	-0.9±2.12	0.82±1.60	0.91±0.79	0.277
Shoulder inclination	-4.82±6.51	-3.27±5.28	1.55±1.74	0.395
Pelvis inclination	-4.64±5.46	-4.91±2.88	-0.27±1.38	0.847
Knee inclination	-6.27±6.53	-4.09±5.21	2.18±2.62	0.425
Ankle inclination	-2.55±3.75	-2.09±2.07	0.45±1.04	0.671
Lateral analysis				
Loss of height	4.64±2.16	5.73±3.07	1.09±0.93	0.267
Shoulder inclination	23.55±11.09	25.55±18.67	2.00±5.89	0.741
Forward head posture	22.00±10.19	20.00±10.97	-2.00±3.35	0.564
Pelvic tilt	45.64±16.88	51.00±18.41	5.36±4.62	0.272
Knee flexion/extension	11.73±15.36	14.91±16.51	3.18±4.38	0.484
Total score				
AP deviation	6.82±2.71	5.00±2.10	-1.82±1.12	0.135
Lateral deviation	15.18±4.96	14.27±3.77	-0.91±1.35	0.516
Total deviation	22.00±5.48	19.27±1.49	-2.73±1.67	0.134

Values are presented as mean±standard deviation.
Δ Score represents the difference in score after 8 weeks from the score before the exercise program in terms of postural balance.
AP, anterior posterior.

social relationships and environment, and overall quality of life (QoL) and general health. Each item was rated on a 5-point scale.

Stress response inventory

The stress response inventory (SRI) scale was used to comprehensively assess and measure stress response across four domains: emotional, physical, cognitive, and behavioral responses.

Self-esteem inventory

The most widely applied tool, the Rosenberg self-esteem scale (RSES) was used to assess self-esteem in the field of psychological counseling. The RSES indicates positive psychological health and allows the assessment of the most fundamental motivational factors that influence human behaviors.

Statistical analysis

All measured data are represented as mean and standard deviation. To analyze the effects of the exercises, a paired sample *t*-test was performed on the pre- and postexercise values. All statistical processing was performed with IBM SPSS Statistics ver. 26.0 (IBM Co., Armonk, NY, USA), and the significance level (α) was set at $P \leq 0.05$.

Table 4. Changes in emotional factors after the 8-week exercise program

Variable	Preintervention	Postintervention	Δ Score	*P*-value
Physical health domain	2.65±0.75	4.03±0.53	1.38±0.93	0.001
Psychological domain	2.46±0.78	3.95±0.59	1.50±0.97	0.001
Social relationships domain	2.79±0.67	3.97±0.71	1.18±0.83	0.001
Environment domain	2.61±0.74	4.03±0.62	1.42±0.90	0.001
Overall QoL and general health	2.95±0.75	4.00±0.45	1.05±0.69	0.001
QoL score	2.63±0.63	4.00±0.47	0.78±0.23	0.001

Values are presented as mean±standard deviation.
Δ Score represents the difference in score after 8 weeks from the score before the exercise program in terms of emotional factors.
QoL, quality of life.

Table 5. Changes in emotional factors after the 8-week exercise program

Measured variables	Preintervention	Postintervention	Δ Score	*P*-value
Stress response inventory	2.97±1.00	1.35±0.28	-1.62±1.07	0.001
Rosenberg self-esteem scale	2.73±0.42	3.47±0.29	0.74±0.52	0.001

Values are presented as mean±standard deviation.
Δ Score represents the difference in score after 8 weeks from the score before the exercise program in terms of emotional factors (stress response and self-esteem).

RESULTS

Changes in postural balance

Table 3 presents the changes in postural balance after the 8-week music-based exercise program. Compared with the time before exercise, none of the variables, including anterior postural imbalance and lateral misalignment, displayed a significant difference.

Changes in emotional factors

In the QoL assessment, the total and mean score of each subcategory displayed significant changes. The differences in the domains of physical health, psychological health, social relationships and environment, as well as in overall QoL and general health were statistically significant ($P<0.001$) (Table 4). The SRI and RSES also displayed statistically significant differences ($P<0.001$) (Table 5).

DISCUSSION

This study aimed to determine the effect of an 8-week music-based exercise program on the postural balance and emotional factors among instrumentalists. The measured changes in postural balance did not reveal a significant positive effect on musculoskeletal imbalance and misalignment, showing deviation. Kava et al. (2010) administered a 6-week Pilates program to undergraduate instrumentalists, which led to a significant improvement in upper limb muscle strength but had no effect on postural alignment. Likewise, Poncela-Skupien et al. (2020) provided a 4-week Pilates interventional program to young string instrumentalists, and similarly, the participants had a positive pain reduction, but the program had no effect on postural alignment. The rhythm in the music-based exercise program in this study allowed for natural movements based on the sense of rhythm in response to external stimuli. Through creative motions that release energy that converges time and space focusing on the participants' inner feelings, certain movements are limited or permitted that revitalize physical functions not usually harnessed. The activity perceives one's own body and reflects potential energy, promoting motion and linking music as a medium with movements. People usually unconsciously use one part of the body repetitively, and in the study, the participants likewise had a habitual posture or pattern of movements. As an intervention, the participants performed freestyle exercises without restriction to their posture or pattern of movements. Thus, the participants did not actively perform structured motions to improve postural imbalance, such as stabilization of a specific area of imbalance, relaxation, stretching of activated muscles, strengthening of weakened muscles, or balancing of asymmetric muscle activities. Consequently, no notable improvement was found in the indicators of postural balance.

In this study, significant improvements were detected across all variables, QoL, stress response, and self-esteem. Regular physical activities are known to enhance physical and psychological health, as well as QoL. A person's QoL is not a simple indicator of survival but a state of subjective psychological well-being, determined by physical, social, and mental health. Thus, maintaining a balance among each domain is critical, and in this study, all assessed subcategories, from physical and psychological health to social relationships and environment, displayed significant changes. In a study on 106 older adults the overall QoL on the World Health Organization Quality of Life scale increased after prescription of a personalized exercise program (Kekäläinen et al., 2018). In a meta-analysis of physical activities and QoL among 19,731 undergraduates, a positive correlation was found between physical activity and overall QoL (Abrantes et al., 2022). In this study, the four subcategories of QoL revealed that the changes induced by satisfaction with the program led to a positive attitude towards life.

The results of this study demonstrated a decrease in stress response and significant increase in self-esteem on the SRI scale and

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RSES, respectively. Exercises such as musical aerobics exert an influence on creativity and self-identity (Herman-Tofler et al., 1998), with a close association to depression, anxiety, stress, mood, and self-respect (Scully et al., 1998). In a study by Ozdemir and Saritas (2019) self-esteem increased after 4 months or more of yoga training, which suggested an effect of physical changes through movements on emotional stability, as the peace of mind after yoga enabled one to reflect on inner strength and regain emotional stability. Sonstroem and Morgan (1989) claimed that a successful exercise could have a positive impact on self-esteem. The findings of these studies imply that physical movements and regular exercise can contribute to reducing stress factors and enhancing one's self-esteem. A recent study reported that rhythm is a repeating pattern of energy that can assist with muscle contraction and relaxation, while a kinesthesia may have a role in the realization of the inner self (Wilson and Henley, 2022). The rhythmics program applied in this study was conjectured to have a positive effect on psychological relaxation, as participants responded to rhythm and sounds through movement, whereby repressed thoughts could be dissipated through movement. Rhythm is present even in the quiet moments between adjacent sounds, and being aware of that rhythm enables humans to regain the balance of sub-consciousness.

In conclusion, all emotional factors had synergistic effect on each other generating improvement. The results of this study showed that rhythmic elements in a music-based exercise program had positive effects on emotional factors, but not on postural balance. Thus, exercise programs for instrumentalists should be designed to incorporate specialized exercises for the improvement of postural balance factors with an intensity that reflects balance-related factors to ensure synergistic effects with music-related factors.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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