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**ORIGINAL ARTICLE**

Brainwave Mastery: Synergizing Brain Gym and Instrumental Music for Peak Concentration

¹Adika Fatahilah^{ID}*, ²Yusuf Hidayat^{ID}, ³Komarudin Komarudin^{ID}, ⁴Jajat Darajat Kusumah Negara^{ID}

¹Physical Education, Health and Recreation Study Program, Faculty of Economics and Business, Universitas PGRI Silampari, Indonesia.

²Department of Sport Science, Universitas Pendidikan Indonesia, Bandung, Indonesia.

³Department of Sport Coaching Education, Universitas Pendidikan Indonesia, Bandung, Indonesia.

⁴Department of Physical Education, Health, and Recreation, Universitas Pendidikan Indonesia, Bandung, Indonesia.

*. Corresponding Author: Adika Fatahilah; E-mail: adika.fatahilah@upi.edu

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**KEYWORDS**

*Brain Waves,
Concentration,
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ABSTRACT

Background. To achieve peak athletic performance, coaches can utilize mental manipulation through psychophysiological effects by maximizing brain potential, which enhances cognitive and motor performance via a neuropsychological approach in training programs. **Objectives.** This study explores the effects of brain gym activities combined with instrumental music on optimizing beta and gamma brain waves and improving concentration. **Methods.** The study employed a quasi-experimental method with a pretest-posttest control group design involving 20 futsal athletes from the student activity unit of Universitas PGRI Silampari (UNPARI). **Results.** Analysis results demonstrate a significant increase in beta and gamma brain waves and improved concentration among participants. **Conclusion.** The findings indicate that combining brain gym activities and instrumental music effectively enhances brain activity and concentration. This research provides new insights into developing training strategies that optimize athletes' performance through a holistic approach, integrating physical and mental aspects.

INTRODUCTION

Enhancing cognitive performance and optimizing brain function have become primary sports-related focus areas in this modern era (1-6).

In sports, optimal concentration and cognitive abilities are keys to success, especially for futsal athletes who must act quickly and accurately in ever-changing situations (7). For futsal athletes, staying focused and thinking quickly is crucial; in a fast-paced and high-intensity match, making the right decision within seconds can determine victory or defeat (8).

Various methods and techniques have been developed to achieve this goal, including using brain gym activities and instrumental music. Brain gym is a series of physical exercises designed to enhance brain function through simple body movements. These exercises improve concentration, coordination, and athletes' cognitive abilities (9). In sports, optimal performance is determined by physical strength, technical skills, and athletes' cognitive and mental capacities (10). Concentration, focus, and quick reactions influence athletes' success in

competitions. Recent research in neuroscience shows that beta and gamma brain waves play important roles in cognitive functions, including attention and information processing. Beta waves (13-30 Hz) are associated with active mental activity, focus, and problem-solving, while gamma waves (>30 Hz) are linked with high-level information processing and memory consolidation (11, 12).

In line with technological advancements and knowledge in neuroscience, instrumental music has also been found to affect brain function positively (13). Instrumental music, particularly with specific rhythms and tempos, can stimulate brain waves, enhance focus, and create optimal mental conditions for learning and working (14). Research has shown that music can influence brain activity, improve mood, and relieve stress (15).

Brain gym activities involving simple physical exercises have been developed to enhance coordination, balance, and cognitive function by stimulating various brain parts (16). Brain gym is believed to increase blood flow to the brain, stimulate neural connections, the limbic and nervous systems, and improve cognitive performance (17). Instrumental music, especially with specific tempos and rhythms, has been proven to influence brain waves, enhance focus, and create a mental environment conducive to concentration (18). Combining brain gym with instrumental music can provide synergistic benefits. The physical activity of the brain gym can help activate and coordinate various parts of the brain, while instrumental music can create a supportive acoustic environment and stimulate brain waves associated with concentration and relaxation (19, 20).

This research explores the effects of combining brain gym activities and instrumental music on optimizing beta and gamma brain waves and athlete concentration. This combination is expected to provide a more significant synergistic effect than each method's application separately. By activating the brain through physical movement and auditory stimulation, athletes can achieve higher levels of concentration, enhancing their performance in training and competition (21).

This study is significant in the context of athlete training. The findings from this research are expected to provide new insights into practical strategies for improving cognitive and mental performance through brain wave control. Additionally, the results of this research can

contribute to the development of more comprehensive training programs that focus not only on physical aspects but also on the development of cognitive and mental capacities. Thus, this research can potentially enhance the overall quality of training and athletic performance.

MATERIALS AND METHODS

This research employed a Quasi-Experimental pretest-posttest group design. Over 18 meetings were conducted, consisting of one meeting for the initial test and 16 for the treatment. The treatment was a brain gym with instrumental music. One meeting was conducted for the final test (22).

Study Design. The research was conducted over six weeks, with meetings held twice weekly. Each of the 18 sessions included one initial test, 16 treatment sessions focused on brain gym exercises with instrumental music, and one final test. The treatment sessions were designed to enhance concentration, and this scheduling allowed for consistent practice and assessment.

Participants. A total of 20 male students from the futsal student activity unit (UKM) at Universitas Parahyangan (UNPARI) were selected using purposive sampling. The sampling in this study used purposive sampling techniques with specified inclusion and exclusion criteria. The inclusion criteria included male students actively participating in the futsal student activity unit at UNPARI who are in good health. The exclusion criteria included individuals with a history of chronic diseases or injuries. The drop-out criteria included participants who did not follow the established procedures or experienced significant health issues during the study. The inclusion criteria for this study required participants to be male students in their first to sixth semesters, actively involved in the futsal student activity unit (UKM) at UNPARI, and in good health, as indicated by normal pulse rates and body temperatures.

Additionally, participants needed to be aware of and consent to the research objectives. The exclusion criteria stipulated that only physically healthy individuals with no history of chronic diseases or injuries were eligible. Furthermore, players needed to be versatile and capable of playing various positions on the futsal team, such as goalkeeper, defender, midfielder, and forward. The drop-out criteria were established to ensure the integrity of the study. Participants who did not adhere to the established procedures or experienced significant health issues—such as

sudden illness, injury, or other conditions requiring rest or medical treatment—were excluded from the analysis. Out of the initial 23 participants, 3 withdrew from the research for these reasons. Consequently, the final sample consisted of 20 participants who completed the study.

Instrument. Research data were obtained using a concentration test instrument, utilizing the Amazing 1 to 50 software on an Android device. Participants were required to tap the numbers from 1 to 50 on the phone screen in the correct order, which had been installed via the Google Play Store. Meanwhile, brain waves were measured using the NeuroSky MindWave Mobile (Brain Wave Sensor). The MindWave Mobile from NeuroSky is an EEG headset that measures and transfers power spectrum data. It communicates wirelessly with a computer, iOS, or Android device via Bluetooth Low Energy (BLE) or Bluetooth Classic (23).

Data Collection. Data collection was conducted at three intervals:

1. Pretest: Initial concentration levels were assessed using the Amazing 1 to 50 application.
2. Intervention: Participants underwent 16 sessions of brain gym exercises.
3. Post-test: Concentration levels were reassessed using the same application to evaluate changes.

Data Analysis. Data analysis employed paired t-tests or independent t-tests to test the significance of the mean difference between the pretest and post-test. The t-test applied is the paired sample test.

RESULTS

Information about brain waves and concentration from the pretest and post-test

data for the group undergoing brain gym exercises with instrumental music is presented in Table 1. This table shows each variable's range of values (maximum and minimum), mean values, and standard deviation.

Results of the descriptive analysis of the pretest and post-test are presented in Table 1. The brain gym treatment with instrumental music significantly changes brain wave activity and concentration.

During the pretest, the values for beta-low, beta-high, gamma-low, and gamma-high brain waves and concentration had specific ranges and averages. After the intervention, in the post-test, there was an average increase in beta-low brain waves by 950.45, beta-high by 2008.7, gamma-low by 4315.35, and gamma-high by 4074.9. Additionally, there was a reduction in duration for the concentration variable by 2.72, indicating an improvement in concentration. These results demonstrate that brain gym exercises with instrumental music can enhance brain wave activity and concentration.

The results of the paired t-test analysis are presented in Table 2. The significance values for each variable are less than 0.05. This indicates that brain gym exercises with instrumental music significantly affect low Beta, high Beta, low Gamma, and high Gamma brain waves and the concentration levels of UNPARI Futsal UKM athletes. In other words, the brain gym treatment with instrumental music can optimize beta and gamma brain waves and improve athletic concentration.

Table 1. Descriptive Statistics for Brain Gym with Instrumental Music.

		n	$\bar{X}$	SD	Min	Max
Low Beta	Pre	20	22591.35	4589.583	15842	31373
	Post	20	23541.80	4707.700	15673	32101
High Beta	Pre	20	19598.10	6900.014	10408	36566
	Post	20	21606.80	6933.508	12209	38349
Low Gamma	Pre	20	14038.95	7846.152	3290	30878
	Post	20	18354.30	7378.763	8591	34767
High Gamma	Pre	20	8244.85	2720.205	3703	13714
	Post	20	12319.75	3129.263	7082	18114
Concentration	Pre	20	44.54	10.564	29	65
	Post	20	41.82	9.575	29	63

n= Number of samples; Min= minimum score; Max= Maximum score; $\bar{X}$ = Average; SD= Standard deviation.

DISCUSSION

Beta waves are associated with high mental activity, focus, and concentration. This study

found a significant increase in low and high Beta waves after implementing brain gym exercises with instrumental music. The average low beta

waves increased by 950.45 and high beta waves by 2008.7. This increase indicates that brain gym exercises with instrumental music can enhance mental activity related to focus and concentration, which is crucial for athletes in competitive situations. Gamma waves are related to high-level information processing, awareness, and the ability to connect various aspects of experiences and perception. The results of this study show a significant increase in low gamma waves by 4315.35 and high gamma waves by 4074.9. This increase suggests that brain gym exercises with instrumental music

can improve complex information processing and the interconnections between brain parts, helping athletes make quick and accurate decisions during matches. Brain gym exercises with instrumental music also showed a significant impact on increasing athletes' concentration. The measured decrease in duration by 2.72 indicates an improvement in concentration. In sports, especially futsal, high concentration is vital to focus on the game, anticipate opponents' movements, and make quick and precise decisions (24).

Table 2. Comparative Analysis of Pretest and Post-test.

Variable	Pretest	Post-test	t	p
	Mean			
BETA Low	22591.35	23541.80	-8.166	0.001*
BETA High	19598.10	21606.80	-19.350	0.001*
GAMMA Low	140348.95	18345.30	-22.805	0.001*
GAMMA High	8244.85	12319.75	-16.656	0.001*
Concentration	49.95	52.46	-6.501	0.001*

*: significant difference in $p < 0.05$

Electrical activity in the brain is crucial for cognitive processes and a person's level of consciousness (25). This electrical activity pattern varies from slow to high-speed waves, depending on a person's mental and cognitive state (26). For instance, an increase in beta waves enhances concentration and awareness (27). Beta waves positively correlate with cognitive functions, including systematic, logical, and analytical thinking (28). Beta waves dominate when a person is in a state of full consciousness and focus, such as while solving problems or making decisions (29).

Additionally, the stability of beta waves can help reduce stress, anxiety, and physical pain (30). However, prolonged dominance of beta waves can cause tension, difficulty relaxing, and insomnia if it occurs at night (31). Concentration is vital for an athlete's performance (32). Research shows that the interaction between beta brain waves and concentration levels can affect athletic performance. Besides beta waves, gamma waves also play an important role in concentration and high-level cognitive functions (33, 34). Gamma waves are associated with memory processing, language, idea formation, and learning and are often linked to high IQ, strong memory, and happiness (35). Low gamma activity can lead to learning difficulties, mental disorders, and limited memory (36). Complex mental activities such as

memory, attention, and learning are often associated with gamma waves (37). Gamma waves help in fast and efficient information processing and synchronization between various brain areas for information coordination and integration (38). Higher gamma activity levels are also linked to happiness and life satisfaction (39). For athletes, having optimal Beta and gamma wave activity is crucial for enhancing concentration, decision-making abilities, and overall performance (40). With sharp concentration and optimal cognitive function, athletes can respond quickly and accurately during matches, manage stress better, and maintain focus in high-pressure situations (41).

Brain gym is a series of exercises that combine physical and mental movements to enhance brain performance. This program includes 26 movements to improve social, mental, emotional, and physical skills. Brain gym exercises help synchronize the brain's right and left hemispheres and the brain's upper and lower parts, thereby improving sensory, motor, and learning integration (42). In addition to brain gym, instrumental music also plays an important role in influencing brain activity. Music arranged in rhythmic, melodic, and dynamic patterns can affect pulse rate, heart rate, and brain waves (43). Music can regulate mood and brain waves, helping to set the mood and increase concentration (44). Preferred music can

enhance focus by influencing brain waves, stimulating the nervous system, and activating the limbic system, which regulates emotions (45). Moreover, music can trigger the release of hormones that support concentration, creating a better mental state for focusing on tasks (46).

The optimization of brain waves is closely related to the limbic system, the nervous system, and hormones in the human body, all of which are important for an athlete's needs. The limbic system, the brain's emotional center, interacts with brain waves to influence mood and motivation, which are crucial for athletes in maintaining enthusiasm and focus during training and competition (47). The autonomic nervous system, which regulates physiological functions such as heart rate and respiration, is also affected by brain wave activity, helping athletes maintain optimal physical performance (48). Hormones such as cortisol and endorphins, released by the endocrine glands, play a role in stress responses and feelings of happiness, helping athletes manage stress and enhance positive feelings (49). Through brain gym exercises and listening to instrumental music, athletes can stimulate the limbic system to boost positive emotions, calm the nervous system to reduce stress, and regulate hormones for physical and mental well-being (50). This combination of methods improves sensory and motor integration, as well as learning and cognitive performance, ultimately supporting athletes' holistic health and optimal performance.

The limitations of this study include a relatively small sample size, which may restrict the generalizability of the results to a broader athletic population. Additionally, the study did not employ a control group, making it difficult to directly attribute the observed increases in brain wave activity to the brain gym exercises and instrumental music, as other external factors may have influenced the outcomes. The concentration and cognitive performance measurements also relied on self-reported data, which could introduce subjective bias.

Future research is recommended to involve larger and more diverse samples, as well as to implement objective measurement methods to strengthen these findings.

CONCLUSION

The optimization of brain waves through brain gym exercises and instrumental music is crucial for enhancing athletic performance. Brain gym exercises facilitate the synchronization of the brain's right and left hemispheres, improving

sensory and motor integration. Meanwhile, instrumental music can positively influence mood and brain wave activity, enhancing concentration and focus. The increases in beta and gamma waves associated with these interventions are linked to improved cognitive functions, such as rapid information processing, precise decision-making, and effective stress management. Additionally, stimulating the limbic system and regulating hormones through these activities can support athletes' emotional and physical well-being, enabling them to perform at their best in competitive settings. Athletes can enhance their cognitive functions, concentration, and overall health by integrating brain gym exercises with instrumental music.

Future studies should explore the long-term effects of brain gym exercises and instrumental music on various athletic populations, including different sports and skill levels. Investigating these interventions' optimal duration and frequency could provide deeper insights into their efficacy. Additionally, incorporating objective measures of cognitive performance and physiological responses, such as brain wave activity, would enhance the reliability of the findings. Examining how these methods interact with other psychological techniques, such as visualization or mindfulness, may also yield valuable information on maximizing athletic performance.

APPLICABLE REMARKS

- Implementing a brain gym with instrumental music can be incorporated into training programs to optimize brain performance, particularly in sports requiring high concentration and fast information processing.

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AUTHORS' CONTRIBUTIONS

Study concept and design: Adika Fatahilah, Yusuf Hidayat, Komarudin, Jajat Darajat Kusumah Negara. Acquisition of data: Adika

Fatahilah. Analysis and interpretation of data: Adika Fatahilah. Drafting the manuscript: Adika Fatahilah, Yusuf Hidayat, Komarudin, Jajat Darajat Kusumah Negara. Critical revision of the manuscript for important intellectual content: Yusuf Hidayat, Komarudin, Jajat Darajat Kusumah Negara. Statistical analysis: Adika Fatahilah. Administrative, technical, and material support: Adika Fatahilah. Study supervision: Yusuf Hidayat, Komarudin, Jajat Darajat Kusumah Negara.

CONFLICT OF INTEREST

The authors declare there is no conflict of interest.

FINANCIAL DISCLOSURE

The authors declare that no financial interests are related to this manuscript's material.

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This study did not receive any funding or support.

ETHICAL CONSIDERATION

This study adheres to the ethical guidelines of Universitas Pendidikan Indonesia (UPI). All participants were informed about the study's purpose and procedures and provided written consent. Participants' data confidentiality was maintained, and the ethics committee approved the study.

ROLE OF THE SPONSOR

The funding organizations involved are public institutions and have no role in the design or conduct of the study.

ARTIFICIAL INTELLIGENCE (AI) USE

This study complies with the journal's policy regarding the use of artificial intelligence.

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