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Effects of Life Kinetic and Brain Gym Training Models On Working Memory and Concentration of Football Athletes

Wisnu Murti Ansyah*, Komarudin

Department of Sports Education, Postgraduate Program, Universitas Pendidikan Indonesia, Indonesia

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Abstract

The purpose of this study was to find out the effect of Life Kinetic and Brain Gym training models on working memory and concentration of junior football athletes and to examine the more effective training model, the Life Kinetic training or Brain Gym training, to improve working memory and concentration of junior football athletes. In this study, the researchers used a quantitative research using the true experiment and the pre-test and post-test two treatment research design. The population of this study were all students of Saswco Bandung U-13 Football School, totalling of 26 people. The samples were selected using total sampling technique. Respondents were given the Life Kinetic and Brain Gym training models 3 times a week, carried out for 4 weeks. The instrument for measuring working memory was The Digit Memory Test, while the instrument for measuring concentration was The Amazing 1 to 50. The hypothesis testing analysis technique used was the Multivariate test. The results of the research for the Life Kinetic and Brain Gym training models on working memory and concentration was sig. 0.000 < 0.05, while the between-subjects effect test value was Sig. 0.000 < 0.05. It shows that there was a difference between Life Kinetic and Brain Gym trainings on working memory and concentration of junior football athletes. In conclusion, the Life Kinetic and Brain Gym training models can improve working memory and concentration of junior football athletes. Life Kinetic training had a better effect than Brain Gym training on working memory and concentration of junior football athletes. It is suggested that further research should recall information more specifically during matches and practices of football games by simplifying Life Kinetic and Brain Gym Exercises.

✉ Correspondence Address : Jl. Dr. Setiabudi No.229, Kota Bandung, Jawa Barat 40154
E-mail : wmurtiansyah@upi.edu

INTRODUCTION

In a sport game, athletes must have good motor skills to perform a complete range of motion and have a good ability to make direct contact with a moving object, such as the ball, during a match. Soccer is a team game, consisting 11 players in each team. One of the players is the goalkeeper. Currently, the development of football, especially in Indonesia, is progressing rapidly. It can be seen, in many cities and remote villages, boys and girls are spotted playing football. Game sports are sports that use more open skill traits, where athletes must anticipate where the ball will land and make quick decisions about where to move (Nuri et al., 2013).

When playing soccer, players need to be aware of their surroundings, determine whether they are protected by their opponents, and find the right position to make it easier for teammates to pass the ball when possessing the ball. Sports require good coordination skills to make complex movements more practical (Çetin et al., 2018). Life Kinetic training is an exercise concept that involves combination of effective cognitive skills in simple skills, such as body adaptation, sensory perception skills, and hand-eye coordination balanced with intellectual tasks into complex exercises (Lutz, 2017). Basically, Life Kinetic training model combines three key elements, including cognitive training, multitasking ability, and physical activity. There are three key areas in Life Kinetic training model, one of those is the cognitive skill. In this cognitive skill, the type of movement is not important, but the decision of movement to perform is vital.

The Brain Gym training is a training that can affect cognitive functions, such as working memory and concentration. Brain gym training reactivates the neural connections between the body and the brain, promoting the flow of electromagnetic energy throughout the body. Brain Gym training stimulates movement. The movement affects brain plasticity associated with synaptic strengthening, supporting better motor stimulations to produce a more coordinated movement and balance.

To enable children to think quickly when receiving and processing information from the environment, the development of a child working memory functions needs attention. Life Kinetic combines three training elements, namely cognitive training, multitasking ability, and physical activity, performed primarily through jogging activities. The training is aimed at stimulating and improving the working systems of the brain concentration, motivation, intelligence, multitasking ability (multiple tasks), memory, attention, stress tolerance, and physical fitness (Komarudin, 2019). Each human cognitive function has its own role. Working memory develops from time to time because working memory capacity is influenced by a variety of factors and is certainly different in children, adolescents, and adults. Working memory is temporarily stored and retrieved under certain circumstances. A limited amount of information is available and useful for many cognitive tasks (Adams et al., 2018). Working memory is the part of memory that stores the information. The perceived thoughts, at any given time, are stored in short-term memory (Slavin, 2013). Working memory is information that is kept active, easily accessible, and can be used for a variety of cognitive tasks in intelligence (Cowan, 2016)

The working memory is needed during the process of memory. Memory is crucial for all humans for everyday activities, such as reading ability and processing speed in receiving information in the learning processes (Parisi et al., 2012). Experts also argue that working memory plays a role in all cognitive processes, such as comprehending language, solving tasks, and performing mathematical operations (Li et al., 2008). Life Kinetic training activities, such as catching movements, throwing objects, and coordinating eyes and limbs, stimulate brain cells and improve an athlete focus. Data show it could improve attention, concentration, and intelligence in children aged 9-13. These exercises involve complex movement patterns that specifically stimulate brain cells in the hippocampus. Although previous studies have confirmed that physical activity, including dynamic life model training, could affect concentration and development in children and intelligence in adults, especially in Indonesia, there is a lack of evidence that it could improve soccer player performance. Similar studies are still limited. Therefore, the authors aimed to further investigate the impact of dynamic life model training on athlete working memory and concentration, particularly concentration and working memory. The study was also aimed to determine the difference of the effect of Life Kinetic training and Brain Gym training models on improving working memory and concentration.

METHODS

In this study, researchers used quantitative study with the true experimental method. Among many types of research available, experiments are considered as the best way to establish causal relationships between variables (Fraenkel, et al., 2012). The design used in this research was the the pre-test and post-test two treatment design.

Participant

Participants of this study were members of the Saswco Bandung Football School aged 13 year old. Sampling technique used in this study was the total sampling technique. The samples of this study were 26 male athletes who were actively practicing football at Saswco Bandung Football School. This study used a random assignment technique to randomly group the subjects into Experimental Groups 1 and 2. Experimental Group 1 consisted of 13 athletes receiving the Life Kinetic training treatment. Experimental Group 2 consisted of 13 athletes receiving the Brain Gym training treatment. The authors randomly assigned papers with numbers from 1 to 26 written on them. The samples then took the paper. The odd-numbered samples were place in the Experimental Group 1 and the even-numbered samples were placed in the Experimental Group 2.

Materials and Apparatus

The measuring instrument used in this study was a Goniometer to determine the degree of difference in the knee joint before and after the treatment. Goniometry is usually used to measure the ability to move active and passive joints. Goniometer is a device that has a unit of measurement in degrees and has an angle of 360 ° for goniometer standards. The range of motion in normal knee joint for flexion is 0 – 120°, while for extension is 0 - 30° (Gandbhir & Cunha, 2023).

Instruments

The Digit Memory Test measuring tool was used to measure the memory ability. The test consisted of two models, namely forward digits and backward digits adopted from (Kane et al., 2004). Another instrument used in this study was the Amazing 1 to 50. The Amazing 1 to 50 is a test to measure a person concentration based on an application developed by Zontanko Biralabs. The application consists of boxes from 1 – 50 arranged randomly. Athletes had to order the numbers from the smallest to the largest. Amazing 1 to 50 was given to athletes twice, before and after receiving treatments. The validity of this instrument is 0.836 and the reliability is 0.871.

Procedures

In the first step, the authors considered the research question and prepared a research draft approved by the supervisor. Then, the population and sample selections were administered. The samples were men's soccer players of the Saswco Bandung Football School. The research tools, in the form of digit memory and concentration tests, were prepared. An initial test was followed by a numeric memory test and an Amazing 1–50 apparatus. Then, exercise groups were assigned according to a randomized assignment scheme.

The study administered at a total of 12 sessions of experimental treatment divided into 3 sessions per week. Regarding the duration of exercise, the exercise was conducted three times a week to prevent chronic fatigue. In addition, the authors provided a 12 session treatment of life kinetic exercise ended by a final test, using the same apparatus, for the Experimental Group 1 and Experimental Group 2. After this, the research raw data were collected, processed, and analyzed so that the statistical data were obtained and explained in detail. In the final step, after the data analysis was completed, the researchers finalized the results of the study and made recommendations and suggestions according to the research conducted.

Design or Data Analysis

The first data test was the data normality test. The normality test used the Kolmogorov-Smirnoff test on SPSS 26. The following step was to perform a homogeneity test. After the data were declared homogeneous, a hypothesis test was carried out using the multivariate test. The comparison between the efficacy of life kinetic exercise and brain exercise was also conducted.

RESULT

Table 1 shows the sig results. (2-tailed) results of less than significant differences ($\alpha = 0.05$) showed Multivariate tests are used based on the processing results in Table , the output results of multivariate tests for improving working memory and concentration Based on

the processing results in Table 1, the results of multivariate tests are also output from the between-subjects effect test table. 0.05 This indicates a difference between Life Kinetic and Brain Gym exercises with respect to working memory and concentration in young soccer players.

Table 1. Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	Working Memory	3507.846	1	3.507.846	57.283	.000
	Concentration	2234.126	1	2.234.126	61.639	.000
Intercept	Working Memory	204.524.462	1	204.524.462	3.339.874	.000
	Concentration	133.823.366	1	133.823.366	3.692.133	.000
Exercise	Working Memory	3.507.846	1	3.507.846	57.283	.000
	Concentration	2.234.126	1	2.234.126	61.639	.000
Error	Working Memory	1.469.692	24	61.237		
	Concentration	869.893	24	36.246		
Total	Working Memory	209.502.000	26			
	Concentration	136.927.385	26			
Corrected Total	Working Memory	4.977.538	25			
	Concentration	3.104.019	25			

Table 2. NGain Life Kinetic and Brain Gym to Working Memory and Concentration

N	N-Gain of Life Kinetic Group to Working Memory	N-Gain of Brain Gym Group to Working Memory
13	0,34	0,1
N	**N-Gain of Life Kinetic Group to Concentration**	**N-Gain of Brain Gym Group to Concentration**
13	0,35	0,1

N-Gain of Life Kinetic and Brain Gym to Working Memory

From the obtained data presented in Table 2, it can be seen that the N-Gain of the Life Kinetic Group on working memory was 0.34 (Moderate) and the N-Gain of the Brain Gym Group on working memory was 0.1 (Low). So, the Life Kinetic training model had a better effect than the Brain Gym training model on working memory of soccer athletes.

N-Gain Life Kinetic and Brain Gym to Concentration

From the obtained data described in Table 1, it can be seen that the N-Gain of the Life Kinetic Group on concentration was 0.35 (Medium) and the N-Gain of the Brain Gym Group on working memory was 0.1 (Low). So, the Life Kinetic training model had a better effect than the Brain Gym training model on concentration of soccer athletes.

DISCUSSION

Doing a regular physical activity with sufficient doses and intensity makes the heart, blood vessels, and respiratory system work properly so that the heart can pump more blood throughout the body in each beat, thus the oxygen and nutritional needs are met (Tarigan, 2017). The life kinetics is useful for the community. Life kinetics has a positive effect on the brain for the formation of new constructs in the brain.

The kinetic life training model can improve concentration and football games. Life kinetic training is more suitable for improving concentration and skill in playing soccer (Komarudin et al., 2021). A well-functioning brain is the decisive factor in mastering any life situation. Life kinetics is a combination of perception and movement. The combination makes the brain more efficient (Moers, 2016). The human brain can adapt to stress-related changes, while stress is one of the vital factors affecting the nervous system. When stress becomes chronic, the brain becomes more vulnerable to situations that increase its adaptive capacity. Negative neural reprogramming due to the inability to adapt to such situations can lead to mental health problems such as depression. However, the negative restructuring can be reversed by engaging in activities that develop the brain and learning new information through neuroplasticity (Uzbay, 2012). Exercise has cognitive benefits and BDNF has been implicated in this mecha-

nism, suggesting that exercise has dynamic effects on memory function (loprinzi et al., 2019).

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In football, the development of sport skills requiring coordination, technical, and tactical qualities is important. The influencing factors, such as muscle strength, maximal movement speed, and neuromuscular activation are also important for an optimal performance. Working memory is the system people use to temporarily store and process information during complex cognitive tasks. Working memory can also be considered an important cognitive function as it underlies the brain ability to store and process information. In addition to physical activity, moderate-intensity exercise can improve working memory (zhidong et al., 2021). Life kinetics can also affect life and have been shown to have a positive impact on improving performance of athletes, both in individual and team sports, to build new brain tissue, reduce nervous system symptoms, and improve performance by increasing concentration (Yarim et al., 2019). Football is a sport of intermittent training of varying intensities. Approximately 88% of soccer game time includes aerobic exercise and 12% includes high-intensity anaerobic exercise. Carbohydrate intake has been found to positively affect performance during intermittent exercise, making it the most commonly used substrate as the pre-exercise performance-enhancing resource (fonseca et al., 2021).

Applying the life kinetic training model to the training process can reduce the stress and induce dynamic concentration, providing a rapid and high-quality learning and improving physical and mental performance. Life kinetic training makes athletes become athletes. Those who practiced it had improved coordination skills and focus on both competition and training (gür et al., 2022). Life kinetics combines an unusual motor task with perceptual and cognitive activity to ensure the creation of new connections between brain cells. This exercise stimulates the brain performance structures with a variety of challenges and stimuli to optimize the performance of brain cells. This exercise also stimulates the brain and helps improve cognitive functions in athletes. Athletes must not only be physically, technically, and tactically strong, they must also be intellectual and have the ability to focus on achieving their goals and tasks. Previous research in life kinetics also suggests that the training improves cognitive performance, coordination, and fitness levels in athletes (cakir et al., 2020). Brain teasers also train children to perform sequences of movements, thereby improving concentration. To improve concentration, doing activities training the concentration is essential. One of them is to do things in order. Performing a movement in a specific sequence helps focus on the movement, reduces distraction, and trains concentration (Castle & Buckler, 2012). Brain gyms are a great source of personal growth and can enable individuals to achieve rapid transformation and improve quality of life for different age groups (Vaishnavi V Siroya et al., 2020).

Coordinated movements, such as walking, running, throwing, grabbing, and catching, improve cerebellar and prefrontal cortex function and executive functions, such as working memory, attentional focus, and cognitive flexibility (budde et al., 2008). Exercise can affect memory and increase BDNF production, which might have a positive effect on improving working memory in athletes (Uysal et al., 2015). Physical activity and cognitive functioning in school-age children (4–18 years) may be related to cognition. Participation in physical activity may improve cognitive performance. It indicates that they are related in all cognitive categories, except memory (Sibley & Etnier, 2003).

Exercise can increase irisin levels and BDNF synthesis. In addition, irisin increases BDNF synthesis and

release, resulting in increased neuroplasticity. This is accomplished through the cooperation of irisin and BDNF. In addition, irisin modulates the stat3 signaling (a transducer and activator of transcription 3), resulting in the coupling of irisin with the BDNF (Figure 1). Irisin modulates stat3 signaling and causes hippocampal proliferation. In this context, exercise and its sequelae, irisin and BDNF, may contribute to hippocampal proliferation and neuroplasticity (Jin et al., 2018). Exercises that allow to move the limbs in both space and time can also train coordination skills, such as eye-hand or leg-arm coordination, obstacle negotiation, and balance to improve speed and dynamic balance. This soccer training program follows a cognitive task training program to improve other motor skills, such as running and explosive leg strength (Alesi et al., 2016). Physical activity-related activities affect the frontal lobes of the brain that help concentration, mental planning, and decision-making. Performing 30 minutes of physical activity daily stimulates the brain (Parrini et al., 2017). It can be explained by the nature of soccer activity. Visual search and the ability to find and select targets at the spatial level require not only selective attention or visual focus and peripheral vision to control attentional focus, but also require more sophisticated metacognitive strategies (Stratton et al., 2004).

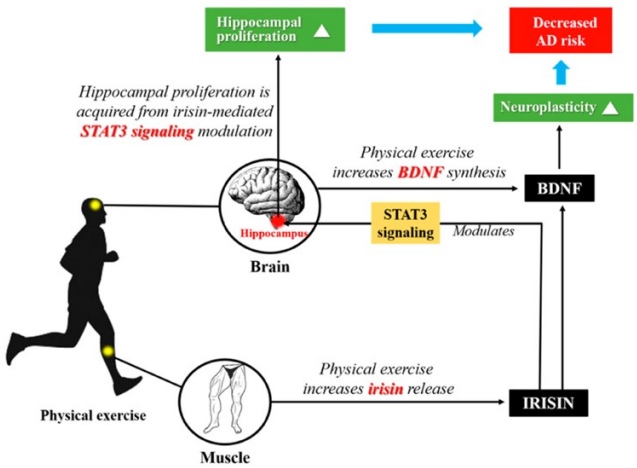

Figure 1. BDNF Formation Scheme during Sports (Jin et al., 2018)

The increase in cognitive function is due to the activity of BDNF in the form of a protein present in high concentrations in the central nervous system, particularly in the hippocampus, cerebral cortex, hypothalamus, and cerebellum. BDNF plays an important role in the growth and resilience of neurons that affect learning and memory. Physiologically, gymnastic movements play a role in the cardiovascular, metabolic, and nervous systems (Huang et al., 2013). The brain gym exercises in this study were based on physiological effects. In this context, exercise has been observed to play an important role in the growth of all types of brain neurons, synaptic plasticity, and working memory strengthening (Griffin et al., 2011). Brain gym training models support focus and brain activity. Brain gym can increase focus, alertness, and the brain ability to plan, react, and make decisions. In addition, regardless of age, brain gym may improve learning ability and enhance comprehension. Changes in concentration levels following brain-training interventions may be influenced by physical factors, including the state of the nervous system, suggesting that intensive activity requires a certain amount of it may affect an individual ability to make information choices. Indeed, the ability of the neurobrain to select specific amounts of information varies from person to person, which can affect concentration (Owen et al., 2010).

Because physical motor activity can occur when a person performs brain-teasing exercises, regular brain-teasing exercises can trigger the release of endorphins. Endorphin hormones make students feel more relaxed and in control of their bodies. Students are more likely to focus their attention when their bodies are relaxed (Zhang et al., 2017). A series of simple range-of-motion exercises that represent an alternative therapy are aimed at improving blood and oxygen flow to the brain and making both brains work. It increases self-confidence, stimulates the right and left hemispheres, relaxes the brain, and improves cognitive function (Paul E. Dennison & Gail E. Dennison., 2011). Exercise increases the hippocampus. High-level mRNA expression of the BDNF gene in the hippocampus and cerebral cortex indicates an important role of BDNF protein gene in brain function, thus reduced expression in the hippocampus is common in alzheimer disease and depression (Ieraci et al., 2015). Exercise results in increased blood flow to the brain, increases the number of BDNF brain cells in the hippocampal region, and releases protective molecules, such as BDNF. This series of processes can improve memory and delay alzheimer disease. Exercise also increases vascular endothelial growth factor in the brain, which can lead to the formation of new capillar-

ies in different parts of the brain. Thereby, it increases blood supply to the brain (Bae et al., 2015).

Endorphins are released during exercise, increasing focus and brain ability to track priorities. In fact, the brain has discovered the ability to focus on mental priorities for longer periods of time (Veening & Barendregt, 2015). Norepinephrine and dopamine affect learning and memory. Regular exercise increases the secretion of these compounds and increases their amount in the plasma. Therefore, regular exercise can improve memory and mood swings (Chowdhury et al., 2012). Exercise increases neutrophins. It may be one of the reasons for the increase in hippocampal volume. Neurotropins are substances that increase nerve cell survival and regeneration, stimulate neuronal growth and development, and aid in memory (Voss et al., 2013). Activation of beta-adrenergic receptors by exercise-induced increases in norepinephrine has been reported to cause increases in BDNF mRNA levels, thus increasing working memory (Ebrahimi et al., 2010).

The life kinetic training model and brain gym training model had an influence on working memory of junior soccer athletes. However, the life kinetic training model group had a better effect compared to the brain gym training model because the life kinetic training model combines the athlete movements, allowing freedom for various skill abilities. The life kinetic training model is required to generate various challenges in the athlete body and cognitive challenges of the kinetic life movements, such as eye and hand coordination, eye and foot coordination, and balance. The brain gym training model involves only more dominant movements, the dynamic body movements between the arms and legs. It is not combined with the actions found in football. The kinetic life training model can activate norepinephrine and dopamine affecting the exercise process and working memory. Performing the life kinetic training model regularly can increase the secretion of these compounds and their amount in blood plasma. Therefore, exercising regularly can strengthen memory and change moods.

The life kinetic training model in football can trigger the release of neurotrophic originating from the brain (BDNF: brain-derived neurotrophic factor), a natural substance that can improve cognition, so that athletes have new movement skills by being given a cognitive challenge. The throwing, catching, and coordinating skills combined with the actions in football and the life kinetic training model or brain gym training model has an influence on the concentration of junior soccer athletes. It is important for athletes to have high concentration skills, both in training and during matches. Movement trainings, such as brain gym, only involve more dominant movements, the dynamic body movements, without combining throwing, catching, or existing actions. Thus, in football, athletes only focus on arm and leg movements. The life kinetic training model has a better effect because the kinetic life training model includes harmony of all organs and body systems as well as their psychological processes by combining coordination movements, such as throwing and catching, with soccer actions. Life kinetic training model also triggers discharge of endorphins. Endorphin hormones can make athletes feel more relaxed and happy. The body is easier to control when it is relaxed, thus it will be easier for athletes to focus their attentions.

CONCLUSION

Based on the research results, the positive effects of exercise using cognitive motor tasks have been associated with increased hippocampal volume (a structure that is sensitive to exercise-induced changes through neurogenesis and cell proliferation) and levels of brain-derived neurotrophic factor (BDNF). It concludes that there was an increase of working memory and concentration in football athletes after using the life kinetic training model and the brain gym training model, where the life kinetic training model had a better effect than the brain gym training model on working memory and concentration of football athletes.

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