

Investigating the Effects of Motor Imagery Practices on Delta Time and Mental Visualization Skills: The Example of Karate-Kata Athletes

Motor İmgeleme Uygulamalarının Delta Zamanı ve Zihinde Canlandırma Becerisi Üzerine Etkilerinin İncelenmesi: Karate-Kata Sporcuları Örneęi

Emre Boz¹

*Correspondence:

Emre BOZ

emrebboz@gmail.com

¹Bayburt University, Faculty of Sports Sciences, Bayburt/TÜRKİYE.
Orcid: 0000-0001-8117-9329



<https://doi.org/10.5281/zenodo.18892787>

Received / Gönderim: 12.10.2025

Accepted / Kabul: 17.02.2026

Published / Yayın: 28.02.2026

Volume 3, Issue 1, February, 2026

Cilt 3, Sayı 1, Şubat, 2026

Abstract

Motor imagery exercises, which contribute to athletic performance as well as learning and rehabilitative mechanisms, are known to yield effective results in various sports branches. This suggests that motor imagery exercises integrated with physical activities can be considered a crucial element of an athlete's multifaceted development. In this context, the primary objective of our research was to examine the effects of motor imagery exercises applied to athletes in the kata discipline of karate on delta time and mental imagery skills. 11 adult kata athletes were included in the study. In this study, designed in a quasi-experimental model, a digital stopwatch was used to calculate delta time, the get-up-and-go test was used, and the Movement Imagery Scale was used to measure mental visualization skills. The study lasted four weeks, and the exercises were administered three days a week before training. These motor imagery exercises included mental imagery exercises related to the Gojushiho sho kata from the Shotokan style. In addition to the pretest measurements taken before the experimental period, posttest data were calculated in the fourth week. After collecting these data, the obtained data were subjected to descriptive analyses in SPSS (Version 26) software, in addition to the Wilcoxon signed-rank test. These analyses revealed a positive improvement in the differences between delta duration and imagery time. Furthermore, significant differences were identified based on the positive mean ranks of the participants' mean scores for both visual imagery and kinesthetic imagery. Consequently, it was determined that motor imagery practices applied to kata athletes contributed to the development of both delta time and mental imagery skills.

Keywords Motor Imagery, Visualization, Delta Time, Karate, Kata.

Öz

Sportif performansa olduęu kadar öğrenme ve rehabilite edici mekanizmalara da katkısı olan motor imgeleme çalışmalarını çeşitli spor branşlarında efektif sonuçlar doğurduęu bilinmektedir. Bu durumu, fiziksel aktivitelere entegre biçimde yapılan motor imgeleme çalışmalarının sporcunun çok yönlü gelişiminin önemli unsurlarından birisi olarak değerlendirmek mümkündür. Bu bağlamda arařtırmamızın temel amacı, karate sporunun kata disiplininden sporculara uygulanan motor imgeleme çalışmalarının delta zamanı ve zihinde canlandırma becerisi üzerine etkilerini incelemektir. Bu amaç doğrultusunda 11 yetişkin kata sporcusu arařtırmaya dahil edilmiştir. Yarı deneysel modelde tasarlanan bu arařtırmada verilerin toplanması için; delta süresinin hesaplanmasında dijital kronometre, kalk ve yürü testi ve zihinde canlandırma becerisinin ölçülmesinde Hareketi İmgeleme Ölçeęi kullanılmıştır. Arařtırma 4 hafta sürdürülmüştür ve çalışmalar haftanın 3 günü antrenman öncesi uygulanmıştır. Bu motor imgeleme çalışmalarında shotokan stilinden gojushiho sho katasına ilişkin zihinde canlandırma çalışmaları gerçekleştirilmiştir. Deney süreci başlamadan alınan ön test ölçümlerine ek olarak 4. haftada son test verileri hesaplanmıştır. Bu verilerin toplanmasından ardından elde edilen veriler SPSS (26. Versiyon) yazılımında tanımlayıcı analizlere ek olarak wilcoxon işaretli sıralar testine tabi tutulmuştur. Bu analizlerin neticesinde delta sürelerinin zaman ve imgeleme zamanı arasındaki farklılıklarda pozitif yönde gelişim sergilemiştir. Buna ek olarak katılımcıların hem görsel imgeleme hem de kinestetik imgeleme ortalama puanlarının pozitif sıra ortalamalarına baęlı anlamlı farklılıklar tespit edilmiştir. Sonuç olarak kata sporcularına uygulanan motor imgeleme uygulamalarının hem delta zamanında hem de zihinde canlandırma becerilerinin gelişimine katkıda bulunduęu tespit edilmiştir.

Anahtar Kelimeler Motor İmgeleme, Zihinde Canlandırma, Delta Zamanı, Karate, Kata

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Introduction

Kata is a sub-discipline of karate, consisting of predetermined movement sequences that structure the fundamental technical, tactical, and stance principles of karate within an aesthetically pleasing whole. Its primary purpose is to simulate a simulative fight against an imaginary opponent and involves the coordinated application of defensive and offensive techniques (Çetintaş, 2021). Each kata has a choreographic structure based on a specific technical philosophy and application logic (Emad et al., 2020). The content, form, and application of kata vary depending on the diversity of styles in karate. The four basic karate styles widely represented in international competitions are Shotokan, Wado-Ryu, Shito-Ryu, and Goju-Ryu (Alpay, 2015). Athletes are entitled to perform a kata from any of these styles in kata competitions. The choice of style is determined by the athlete's individual preference. Kata competitions are non-contact. Each athlete individually presents their preferred kata during the competition. Performances are performed sequentially and evaluated by seven judges across two main categories: technical performance (70%) and athletic performance (30%). Technical evaluation includes criteria such as balance, timing, correct technical execution, and posture, while athletic evaluation encompasses elements of power, speed, and rhythm (WKF, 2025).

In the kata discipline of karate, not only the physical abilities of athletes but also their cognitive and psychological competencies are of paramount importance. Kata performance, which requires the execution of predetermined technical combinations in the correct order, rhythmically, and aesthetically, necessitates the effective use of fundamental mental skills such as intense attention, focus, mental stamina, and decision-making (Piepiora et al., 2017). In this context, mental imagery techniques are a critical tool for both enhancing athletes' technical success and supporting their psychological preparation before performance. Mental imagery strengthens cognitive representations of movement, facilitating motor learning and reducing the likelihood of errors (Georgios, 2016). Furthermore, imagery exercises reduce competition anxiety, increase self-confidence, and contribute to athletes' more consistent performance on the field (Boz & Kul, 2020). Therefore, mental skills and mental imagery techniques in kata practice should be considered as an integral part of both the training process and competition preparation. When considering motor imagery exercises, the development of cognitive and psychological skills may come to mind first. However, by improving both visual and kinesthetic imagery skills, athletes can create clearer and more accurate mental representations of movements. This development supports the improvement of elements that directly impact performance, such as movement timing, rhythm, and coordination (Dilek et al., 2019). At this point, an important performance indicator that should be considered in conjunction with the motor imagery process is delta time.

Delta time refers to the difference between the duration of a mentally visualized movement and the physical execution of the same movement and is usually measured using a mental stopwatch. This time difference is considered a quantitative indicator of an individual's motor imagery capacity. Delta time is particularly important for determining how close the movement is to its mental representation. In this context, delta time not only reflects the accuracy of imagery skills but also provides information about the functionality of the cognitive mechanisms underlying this process. This is because the motor imagery process is governed, particularly by higher cortical centers of the central nervous system (Allali et al., 2012).

An increase in delta time may indicate a decrease in processing efficiency in these higher-level cognitive centers, resulting in the individual's inability to synchronize with actual movement during mental imagery. This suggests impairments in higher-level mental processes such as motor planning, perceptual timing, and movement

programming. Consequently, a high delta time can be interpreted as a reflection of lower motor imagery ability and suggests limitations in the individual's ability to mentally represent motor performance (Kahraman et al., 2018).

In light of all these data, the primary purpose of this study was to examine the effects of motor imagery exercises applied to athletes in the karate kata discipline on delta time and mental imagery skills. It is believed that motor imagery techniques contribute to improving athletes' performance by both reducing movement time differences (delta time) and improving mental imagery skills. Based on this idea, the following hypotheses were tested. These are:

H₁ Motor imagery exercises applied to kata athletes have an effect on the deviation related to delta time.

H₁ Motor imagery exercises applied to kata athletes have an effect on visual and kinesthetic imagery skills.

Materials and Methods

Research Model

This study, which aimed to examine the effects of motor imagery practices on delta time and mental imagery skills, employed a quasi-experimental design, a quantitative research model. A quasi-experimental research design is a type of research that uses limited experimental control but implements an intervention or treatment, aims to examine cause-and-effect relationships, and is closer to real-life situations (Maciejewski, 2020).

Research Group

The study group consisted of 11 kata athletes ($n = 7_{\text{male}} + 4_{\text{female}}$) with a mean age of 23.6 (± 1.78). The study group was determined to be within the belt level specified in the Turkish Karate Federation's instructions and required for participation in competitions in this age group. G*Power software was used to calculate the sample size without including all competent participants in the experimental process.

Based on the results of this analysis method, which was conducted by taking the findings of studies similar to our research model and research groups as reference, it was determined that a sample size of at least 11 people would be sufficient for an effect size of 0.32 at 95% difficulty and a 95% confidence interval. Considering the possibility of continuous non-participation (20%), the study began with 14 kata athletes. However, three participants were excluded from the study due to absenteeism and injuries during physical training.

Data Collection Tools

The first form of the Movement Imagery Scale (Revised Form) was used in the data collection process. This scale was initially developed by Hall, Pongrac, and Buckholz (1985). This scale, which was subsequently revised and simplified, consists of eight items. Its subscales measure "visual imagery (4 items)" and "kinesthetic imagery (4 items)" (Gregg, Hall, McGowan, & Hall, 2011). Akkarpat (2014) conducted the reliability and validity studies for this scale in Turkish, and calculated the reliability values as $\alpha = .89$ for visual imagery and $\alpha = .88$ for kinesthetic imagery. Each item of this scale, which has four items under each subscale, consists of three stages. Finally, a video camera and a stopwatch were used to record the participants' kata performances and the images used in the walking test to calculate the performance scores used to determine each participant's delta time.

Data Collection and Application Process

The imagery scenario used in the study was developed using the opinions of three expert academics in the field of sports psychology. This scenario was based on the techniques of the gojushiho sho kata, most commonly used in karate kata competitions (Novosad, Argajova & Augustovicova, 2020; Augustovicova et. al., 2025).

The imagery scenario was performed for a total of 4 weeks, 3 days a week, before physical training for approximately 12 minutes. In this context, a review of the relevant literature suggests that 4 weeks of practice is sufficient for the development of imagery skills (Lindsay et al., 2023; Toth et al., 2020). Pretest measurements were conducted at the beginning of this process, and posttest measurements were conducted in the fourth week. Participants continued their physical kata training throughout the experiment.

In the pretest measurement, participants were first asked to perform the gojushiho sho kata, and the time elapsed during this performance was recorded. They were then asked to mentally recreate the same performance with their eyes closed, starting and ending the time with a stopwatch. The time between each performance constituted a parameter of the different delta time. Another calculation of delta time was made using the “get up and go” test. This test, administered according to standard protocols, begins with the participant sitting in a standard chair and rising from it at the command “go.” They are then asked to walk a 3-meter distance, then return to their seat and sit back down. The stopwatch is stopped when their hips touch the chair, and the time is recorded (Allali et al., 2012).

Finally, a three-stage evaluation form (Movement Imagery Scale) is administered. In the first stage, the participant stands in a starting position, and in the second stage, they are asked to perform a simple motor movement. In the third stage, they are asked to visualize the starting position and the physical movement. The task requested from the participant here is to visualize the starting point and the movements they have performed, focusing on “seeing” and “feeling.” After the final stage, imagery, the participant scores the ease and difficulty of imagining this movement, with 1 (difficult) being the lowest and 7 (easy) being the highest.

Data Analysis

Participants' opinions were obtained using the forms used for data collection, and the raw data were first coded in Microsoft Excel. Following this coding, the data were transferred to SPSS (Version 26). The suitability of the variables for a normal distribution was assessed by examining the Shapiro-Wilk test results, as well as histograms and probability plots. Because the variables did not exhibit a normal distribution, the Wilcoxon signed-rank test, a non-parametric test, was used. In all these tests, the significance level was set at “ $p < 0.05$.”

Findings

Table 1: Descriptive analysis results regarding the pre-test and post-test results of the research group.

| | Pre-Test Delta Time (Kata) | Pre-Test Delta Time (Get Up and Walk) | Pre-Test Kinesthetic Imagery | Pre-Test Visual Imagery | Post-Test Delta Time (Kata) | Post-Test Delta Time (Get Up and Walk) | Post-Test Kinesthetic Imagery | Post-Test Visual Imagery |
|---------------|----------------------------|---------------------------------------|------------------------------|-------------------------|-----------------------------|--|-------------------------------|--------------------------|
| n | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| X | 3.42 | 1.96 | 2.66 | 4.03 | 1.07 | .84 | 4.52 | 6.25 |
| Median | 3.00 | 2.00 | 2.50 | 4.00 | 1.00 | .50 | 5.00 | 6.00 |
| sd. | .710 | .502 | .955 | .515 | .638 | .350 | .961 | .954 |

Table 1 shows the descriptive analysis results regarding the pre-test and post-test results of the research group. These results were calculated as Pre-Test Delta Time (Kata) ($X=3.42; \pm.710$), Pre-Test Delta Time (Up and Go) ($X=1.96; \pm.502$), Pre-Test Kinesthetic Imagery ($X=2.66; \pm.955$), Pre-Test Visual Imagery ($X=4.03; \pm.515$), Post-Test Delta Time (Kata) ($X=1.09; \pm.638$), Post-Test Delta Time (Up and Go) ($X=.84; \pm.350$), Post-Test Kinesthetic Imagery ($X=4.52; \pm.961$) and Post-Test Visual Imagery ($X=6.25; \pm.954$).

Table 2: Wilcoxon signed-rank test results regarding the pre-test and post-test results of the delta time scores of the research group.

| Delta Time | | | n | Rank Average s | Rank Totals | Z | p |
|-----------------|----------------------|---------------|---|-------------------|-------------|-------|-------|
| Kata | Post-Test – Pre-Test | Negative Rank | 1 | 3.20 | 21.00 | 2.357 | .017* |
| | | Positive Rank | 0 | .00 | .00 | | |
| | | Equal | 0 | | | | |
| | | | | | | | |
| Get Up and Walk | Post-Test – Pre-Test | Negative Rank | 1 | 3.00 | 19.00 | 2.213 | .024* |
| | | Positive Rank | 0 | .00 | .00 | | |
| | | Equal | 1 | | | | |
| | | | | | | | |

**p<0,05*

Table 2 presents the Wilcoxon signed-rank test results for the study group's kata and get up and go test results. According to these test results, a statistically significant difference was found between the pre-test and post-test delta values for the participants' kata performance ($Z=2.357; p<0.05$). Similarly, a statistically significant difference was found between the pre-test and post-test delta values for the get up and go test performance ($Z=2.213; p<0.05$). These differences were found to be due to negative mean ranks.

Table 3: Wilcoxon signed-rank test results regarding the pre-test and post-test results of the study group's movement imagery scale scores.

| Delta Time | | | n | Rank Average s | Rank Totals | Z | p |
|---------------------|----------------------|---------------|---|-------------------|-------------|-------|-------|
| Kinesthetic Imagery | Post-Test – Pre-Test | Negative Rank | 0 | 0 | 0 | 3.293 | .002* |
| | | Positive Rank | 1 | 6.50 | 25.00 | | |
| | | Equal | 1 | | | | |
| | | | | | | | |
| Visual Imagery | Post-Test – Pre-Test | Negative Rank | 0 | 0 | 0 | 2.866 | .009* |
| | | Positive Rank | 1 | 6.50 | 25.00 | | |
| | | Equal | 1 | | | | |
| | | | | | | | |

**p<0,05*

Table 3 presents the Wilcoxon signed-rank test results for the study group's movement imagery scale scores. According to these test results, a statistically significant difference was found between the pre-test and post-test values for the participants'

kinesthetic imagery scores ($Z=3.293$; $p<0.05$). Similarly, a statistically significant difference was found between the pre-test and post-test values for visual imagery scores ($Z=2.866$; $p<0.05$). These differences were found to be due to positive mean ranks.

RESULTS AND DISCUSSION

The primary objective of this study was to investigate the effects of structured motor imagery exercises on both the physiological and psychological performance indicators of kata athletes, specifically focusing on delta time and mental imagery skills. Within the context of this objective, motor imagery exercises were systematically applied to a sample of athletes practicing kata, a highly technical and cognitively demanding form of martial art. The findings of the study revealed a statistically significant and positive improvement in the delta times of the athletes following the intervention. This reduction in delta time, which reflects the athletes' enhanced processing speed and reaction capability, serves as empirical evidence supporting the effectiveness of motor imagery not only in facilitating mental preparedness but also in augmenting neuromuscular responsiveness. In this regard, the observed improvements align with existing literature that emphasizes the influence of motor imagery practices on temporal coordination and reaction time enhancement (Guillot & Collet, 2008).

In addition to improvements in physiological markers, the study also demonstrated significant enhancements in mental imagery dimensions. More specifically, both visual and kinesthetic imagery scores exhibited notable increases after the implementation of the motor imagery program. These changes, as revealed by the direction of the positive mean ranks in statistical analyses, underscore the multifaceted nature of motor imagery as a psychological skill. This is consistent with the conceptual framework proposed by Akkarpat (2014), which regards motor imagery as a multidimensional construct encompassing both sensory-perceptual and motor-executive components.

From a theoretical standpoint, visual imagery refers to the mental simulation of movement as perceived externally a visual mental representation of motor actions. Kinesthetic imagery, on the other hand, entails an internalized perception, focusing on the bodily sensations and proprioceptive feedback associated with movement. Taken together, these two imagery types represent complementary yet distinct aspects of the cognitive-motor interface. The data obtained in this study suggest that motor imagery exercises can simultaneously stimulate and improve both these modalities, thereby enhancing athletes' internal and external perceptual-motor awareness (Morris, Spittle & Watt, 2005). This dual activation is particularly relevant for kata athletes, whose performance depends not only on the execution of precise physical techniques but also on the accurate mental rehearsal of those techniques under varying cognitive loads.

When the broader implications of these findings are considered, it becomes evident that motor imagery occupies a central position in the interaction between cognitive processing, motor learning, and physical performance. Supporting this perspective, Dhoubi et al. (2021) found empirical evidence indicating that imagery training contributes to the acquisition and consolidation of motor skills through neurocognitive pathways. In a similar vein, Bhattacharya et al. (2023), in an observational study focused on karate athletes, argued that the execution of karate techniques requires the orchestration of superior cognitive functions in tandem with high-level motor coordination. They further proposed that karate functions not solely as a combat sport but also as a neuro-facilitator, promoting enhanced cortical activity and neural efficiency.

The findings of the current study are further substantiated by neuroimaging research in the domain of sports psychology and neuroscience. For instance, Filgueiras et al. (2018) reported significant activation in key brain regions including the premotor cortex,

somatosensory areas, supplementary motor areas, inferior and superior parietal lobules, caudate nucleus, cingulate cortex, and cerebellum during both visual and kinesthetic motor imagery tasks. These areas are known to be critically involved in motor planning, execution, and sensory integration. The current study, by showing improved performance outcomes in kata athletes following motor imagery training, provides behavioral support for these neural activation patterns. It is plausible to suggest that the brain regions activated during imagery tasks contribute meaningfully to the observed improvements in timing and motor coordination.

Notably, previous research focusing specifically on kata athletes such as the study conducted by Piepiora, Jurczyk, and Weinhardt (2017) also demonstrated that regular application of imagery techniques enhances mental imagery capabilities. Likewise, Fajar et al. (2018) found that mental imagery practices contributed not only to improved technical proficiency and skill execution but also to elevated sport-specific self-confidence among kata athletes. More recently, Widyastuti et al. (2024) emphasized the role of imagery in fostering athletes' self-efficacy, positing that an increased sense of competence leads to more consistent and effective athletic performance across diverse competitive settings.

Collectively, these findings highlight the role of motor imagery not only in refining mental imagery skills but also in facilitating the transfer of these skills to actual motor performance. When these effects are evaluated specifically within the framework of kata a discipline that demands precision, rhythm, and synchronization motor imagery appears to exert a particularly strong influence on the timing, coordination, and overall execution of complex technical sequences. This further implies that the benefits of imagery-based training extend beyond the psychological domain, reaching into the neuromotor systems that govern skilled movement. Indeed, existing literature underscores that mental rehearsal can enhance performance through increased activation in motor-related brain regions, such as the primary motor cortex (Decety, 1996; Ladda et al., 2021).

In the context of cognitive load and motor complexity, Al-Ebiary et al. (2020) noted that advanced kata routines, such as gojushiho sho, are highly intricate and characterized by varying rhythms and transition patterns. These routines demand not only refined motor skills but also elevated levels of cognitive processing, attention, and sequential memory. The present findings, which suggest that motor imagery can improve both the mental and physical components of such routines, gain further relevance when considered alongside these observations.

In conclusion, this study provides strong evidence that motor imagery training exerts significant effects on both physiological performance indicators (i.e., delta time) and psychological skill development (i.e., visual and kinesthetic imagery abilities) in kata athletes. The results support the integration of mental training modalities into traditional physical training regimens, particularly in sports like kata that emphasize technical accuracy, consistency, and high levels of motor control. Based on the findings, it is recommended that coaches, trainers, and sport psychologists incorporate structured motor imagery exercises into athlete development programs. Furthermore, future research exploring the differential effects of motor imagery across various demographic factors such as age, gender, and experience level is warranted to deepen our understanding of how individual differences may moderate the efficacy of such interventions. These lines of inquiry could offer valuable contributions to both applied sport science and theoretical models of motor learning and imagery.

Kısaltmalar / Abbreviations

| | |
|---------|--|
| SD | Standart sapma (Standard deviation) |
| X | Ortalama (Mean) |
| SPSS | Sosyal bilimler için istatistik paketi (Statistical package for the social sciences) |
| p value | Anlamlılık değeri (Significant value) |
| t value | T değeri (T value) |
| N | Katılımcı sayısı (Number of participant) |
| Min | Minimum (Minimum) |
| Max | Maksimum (Maximum) |
| BMI | Vücut kütle indeksi (Body mass index) |
| Kg | Kilogram (Kilogram) |
| Cm | Santimetre (Centimeter) |
| L | Litre (Liter) |
| Kcal | Kilokalori (Kilocalorie) |
| W | Wat (Watt) |

Beyanlar / Declarations

Etik Onay ve Katılım Onayı / Ethics approval and consent to participate

Bu çalışmanın hazırlanması ve yazımı sırasında, "Yükseköğretim Kurumları Bilimsel Araştırma ve Yayın Etiği Yönergesi" kapsamında bilimsel, etik ve atıf kurallarına uyulmuş ve Bayburt Üniversitesi Etik Kurulu'ndan onay alınmıştır. Çalışmaya başlamadan önce tüm katılımcılardan yazılı bilgilendirilmiş onam da alınmıştır. Toplanan verilerde herhangi bir tahrifat yapılmamış olup, bu çalışma başka bir akademik yayına değerlendirilmek üzere sunulmamıştır. Bu maddede belirtilen ihlallerden doğacak sorumluluk yazara aittir.

During the preparation and writing of this study, scientific, ethical, and citation rules were adhered to within the scope of the "Higher Education Institutions Scientific Research and Publication Ethics Directive," and approval was obtained from the Bayburt University Ethics Committee. Written informed consent was also obtained from all participants before the study began. No falsification was made to the collected data, and this study was not submitted for evaluation to any other academic publication. Responsibility for any violations of this article rests with the author.

Veri Ve Materyal Erişilebilirliği / Availability of data and material

Bu çalışmanın bulgularını destekleyen veriler, makul talepler üzerine sorumlu yazardan temin edilebilir. Veri seti yalnızca akademik amaçlar için erişilebilir olacak ve verilerin herhangi bir kullanımı, orijinal çalışmayı referans gösterecek ve katılımcıların gizliliğini koruyacaktır.

The data that support the findings of this study are available from the corresponding author upon reasonable request. The dataset will be accessible only for academic purposes, and any use of the data will recognize the original study and maintain the confidentiality of the participants.

Çıkar Çatışması / Competing interests

Yazarlar, bu makalede sunulan çalışmayı etkileyebilecek herhangi bir çıkar çatışması veya kişisel ilişkiye sahip olmadıklarını beyan etmektedirler.

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Yazar Katkıları / Authors' Contribution Statement

Çalışmanın tasarımı ve planlanması, veri toplama, analizi ve yorumlanması, makalenin yazımı, veri düzenleme, yöntem belirleme, yazım – özgün taslak, yazım – gözden geçirme ve düzenleme tüm süreçler Emre Boz tarafından yürütülmüştür. Makalenin önemli noktaları eleştirel olarak gözden geçirilmiş ve son hali onaylanmıştır.

Design and planning of the study, data collection, analysis and interpretation, manuscript preparation, data organization, methodology development, writing – original draft, writing – review and editing were all carried out by Emre Boz. The key points of the manuscript were critically reviewed and the final version was approved.

Fon Desteği / Funding

Bu çalışma, kamu, özel veya kar amacı gütmeyen sektörlerdeki fon sağlayıcı kurumlardan herhangi bir özel destek almamıştır.

This research received no external funding.

Teşekkür / Acknowledgements

none.

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