

The effect of special exercises using some auxiliary tools to develop some bio-kinetic abilities and the accuracy of the crushing and snatch forehand strikes among badminton players

El efecto de ejercicios especiales que utilizan algunas herramientas auxiliares para desarrollar algunas habilidades biocinéticas y la precisión de los golpes de derecha aplastantes y de arranque entre los jugadores de badminton

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Abstract. The best means and ways to develop an athlete's physical and skill capabilities, and among these means is the use of training aids that help develop some bio-kinetic abilities, and prepared exercises have had an important role in improving athletic performance in badminton, where the player must possess physical fitness, explosive power, and strength. Characterized by speed as well as accuracy, awareness, and focus while playing on the court, the badminton player must be physically fit through a continuous movement of small and large muscles to achieve good performance, which requires special physical abilities and skills, and the most important of these bio-kinetic abilities are agility, coordination, and measuring the coordination between the eye and the arm. These abilities are needed by the badminton player while playing on the court. The study aimed to prepare special exercises using some auxiliary tools to develop some bio-kinetic abilities and the accuracy of the crushing and lightning forehand strikes among badminton players, in addition to identifying the effect of special exercises using some auxiliary tools on For badminton players, the researcher adopted the experimental method, and the sample number was (10) players from the badminton training center in the Armenian club, aged (17-19). They were distributed into two experimental and control groups, and they were chosen randomly because the research objectives require the use of athletes proficient in the game's technical performance. The researcher applied her main experiment using special exercises with some auxiliary tools, with (4) training units per week for (8) weeks. The results of the study showed that there was a positive effect on the results of bio-kinetic abilities between the two groups and in favor of the experimental group. It was shown in the kinetic response speed test for the first experimental group 7.423, agility 3.012, and compatibility 3.123, and for the second experimental group in the kinetic response speed test 3.208, agility 6.861, and compatibility 6.907. As for the skill tests for the first experimental group, the front smash hit was 7,234 and the diagonal front snap shot was 28.00. It was shown in the skill tests for the second experimental group that the front smash hit was 3,372 and the diagonal front snap shot was 3,400, which included exercises. The researcher recommends adopting the results of this study and disseminating them, and emphasizing equipping the stadiums with modern training methods, due to the results they achieve. Positive physical development serves one of the goals of sustainable development: good health and good education.

Keywords: Special exercises, Assistive tools, Bio-kinetic abilities

Resumen. Los mejores medios y maneras de desarrollar las capacidades físicas y de destreza de un atleta, y entre estos medios está el uso de ayudas de entrenamiento que ayudan a desarrollar algunas capacidades biocinéticas, y los ejercicios preparados han tenido un papel importante en la mejora del rendimiento atlético en el bádminton, donde el jugador debe poseer aptitud física, potencia explosiva y fuerza. Caracterizado por la velocidad, así como por la precisión, la conciencia y la concentración mientras juega en la cancha, el jugador de bádminton debe estar en buena forma física mediante un movimiento continuo de los músculos pequeños y grandes para lograr un buen rendimiento, lo que requiere habilidades y destrezas físicas especiales, y las más importantes de estas habilidades biocinéticas son la agilidad, la coordinación y la medición de la coordinación entre el ojo y el brazo. Estas habilidades son necesarias para el jugador de bádminton mientras juega en la cancha, y el estudio tuvo como objetivo preparar ejercicios especiales utilizando algunas herramientas auxiliares para desarrollar algunas habilidades bio-cinéticas y la precisión de los golpes de derecha aplastantes y relámpagos entre los jugadores de bádminton, además de identificar el efecto de los ejercicios especiales utilizando algunas herramientas auxiliares en Para los jugadores de bádminton, el investigador adoptó el método experimental, y el número de la muestra fue de (10) jugadores del centro de entrenamiento de bádminton en el club armenio, con edades comprendidas entre (17-19). Se distribuyeron en dos grupos experimental y de control, y se eligieron al azar porque los objetivos de la investigación requieren el uso de atletas competentes en el rendimiento técnico del juego. La investigadora aplicó su experimento principal utilizando ejercicios especiales con algunas herramientas auxiliares, con (4) unidades de entrenamiento por semana durante (8) semanas. Los resultados del estudio mostraron que hubo un efecto positivo en los resultados de las habilidades bio-cinéticas entre los dos grupos y a favor del grupo experimental. Se demostró en la prueba de velocidad de respuesta cinética para el primer grupo experimental 7.423, agilidad 3.012, y compatibilidad 3.123, y para el segundo grupo experimental en la prueba de velocidad de respuesta cinética 3.208, agilidad 6.861, y compatibilidad 6.907. En cuanto a las pruebas de habilidad para el primer grupo experimental, El golpe frontal smash fue de 7,234 y el golpe frontal diagonal snap shot fue de 28,00. En cuanto a las pruebas de habilidad del segundo grupo experimental, el golpe frontal fue de 3,372 y el tiro frontal diagonal de 3,400, lo que incluye ejercicios. El investigador recomienda adoptar los resultados de este estudio y divulgarlos, así como hacer hincapié en equipar los estadios con métodos modernos de entrenamiento, debido a los resultados que obtienen. El desarrollo físico positivo sirve a uno de los objetivos del desarrollo sostenible: la buena salud y la buena educación.

Palabras clave: Ejercicios especiales, herramientas de ayuda, habilidades biocinéticas

Fecha recepción: 22-07-24. Fecha de aceptación: 01-10-24

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Introduction

The field of physical education has witnessed great development, which was demonstrated by the levels that countries have reached in this field. This development was the result of the interest of many specialists in conducting research and studies to identify the best means and ways to develop the athlete's physical and skill capabilities (Alfurqan et al., 2024; Casey & Kirk, 2020; Siedentop & Van der Mars, 2022; Weinberg & Gould, 2023). However, there remains a clear gap in understanding the specific challenges badminton players face in developing bio-kinetic abilities essential for game performance, particularly in executing accurate and powerful forehand strikes. This research seeks to address the problem of inadequate development of these abilities, which has hindered players from achieving peak performance during matches. Among these means is the use of training aids that help to develop some bio-kinetic abilities and therefore, this study specifically focuses on preparing exercises with auxiliary tools to target these abilities. Prepared exercises that have an important role in improving athletic performance in all sports (Bouteraa et al., 2020; Effendi et al., 2024; Prentice, 2024), especially badminton, where the player must possess physical fitness, explosive power, and speed-related strength, as well as accuracy, awareness, and concentration while playing on the court (Alanen et al., 2021; Fernandez-Fernandez et al., 2022; Okilanda, Ihsan, et al., 2024). The problem this study addresses centers on the deficiency in badminton players' bio-kinetic abilities and the associated decline in the accuracy of forehand strikes, both smashing and lightning varieties. Many players face significant challenges in executing these strokes with the necessary precision and power, a situation that negatively affects their overall performance in competitive play. Therefore, the research question asks: *Can the implementation of special exercises using resistance tools enhance the bio-kinetic abilities and improve the accuracy of forehand strikes in badminton players?*

The badminton player must be characterized by physical fitness through a continuous movement of small and large muscles to achieve good performance (Jaworski et al., 2023; Ma et al., 2024; Syaputri et al., 2024). Badminton is one of those sports that requires special physical abilities and skills (Jaworski et al., 2020; Pamungkas et al., 2022), and the most important of these bio-kinetic abilities are agility, coordination, and measuring coordination between the eye and the arm (Effendi et al., 2024; Okilanda, Putri, et al., 2024; Tohme & Odeh, 2022). These abilities are needed by the player in badminton during defence and attack between competitors, and using the resistance of rubber ropes to develop some bio-kinetic abilities and the accuracy of the crushing and lightning forehand strikes among badminton players. The importance of the research lies in preparing exercises that help develop some of the bio-kinetic abilities of the arms and legs and the accuracy of the crushing and lightning

forehand strokes among badminton players. The research aims to systematically investigate whether the implementation of special exercises using resistance tools leads to measurable improvements in the bio-kinetic abilities necessary for badminton performance. The problem of the research lies in that the world is witnessing a tremendous revolution of broad progress thanks to the use of modern means, based on how to benefit from modern scientific techniques and capabilities and discover what is new to achieve the best results in training and competition. Therefore, the research not only attempts to identify effective solutions to the bio-kinetic shortcomings in badminton players but also contributes to advancing knowledge in sports science through evidence-based training methodologies.

Therefore, we find that most badminton players face. Weakness and problem in performing the forehand stroke, which requires the necessary preparation of special exercises for physical and skill preparation using the types of pulling and pushing exercises with rubber ropes that have strong, flexible resistance and have an impact on developing the level of physical and skill performance of badminton players, and the multi-exercise device is built on modern and studied scientific foundations. Hence, the problem of the research centers on preparing special exercises that help develop some bio-kinetic abilities and develop the accuracy of the forehand smashes and flashes among badminton players. The research aims to prepare special exercises and identify the effect of the exercises to develop some bio-kinetic abilities and the accuracy of the smashes and flashes forehands among badminton players. The research hypotheses lie in the presence of statistically significant individual differences between the results of the pre-and post-tests and in favor of the post-test in tests of some bio-kinetic abilities. There are statistically significant differences between the results of the pre-and post-tests and in favor of the post-test in the accuracy of the sweeping and lightning forehand shots among badminton players.

Method

The research method is considered the basic matter in carrying out scientific research, as the method "is the deliberate change controlled by the specific conditions of an event, and observing and interpreting the resulting changes in the event itself" (Dalen, 1984). This study adopts an exploratory experimental design, which seeks to establish a cause-and-effect relationship between the special exercises using auxiliary tools and the improvement in bio-kinetic abilities and accuracy of forehand strikes among badminton players. The study's aim is to move beyond mere description and into analyzing how these exercises influence performance, thereby laying the groundwork for future in-depth research on this topic. The researcher used the experimental method because it suits the nature of the problem of the research "which is concerned with by clarifying the reality of incidents, and reporting their current

facts through analysis and evaluation to derive important conclusions to correct this reality, update it, or create new knowledge about it” (Dayem, 1985);(Hashim & Salman, 2024). The research's specific objective was to assess whether significant differences exist between an experimental group undergoing special exercises and a control group receiving standard training, which would validate the hypotheses that these specific exercises result in superior bio-kinetic abilities and improved strike accuracy. The research sample consisted of badminton players, and number was (10) players from the badminton training center at the club. Armenian and they were distributed into two groups, experimental and control, and they were chosen randomly because the objectives of the research require the use of athletes who are proficient in the technical performance of the game. This random selection helped eliminate selection bias, ensuring the homogeneity of the groups and enhancing the validity of the experimental outcomes. The inclusion criteria were badminton players aged 17-19 years, with at least two years of consistent training experience. In terms of research scope, this study is exploratory in nature, focusing on understanding the influence of specialized exercises on bio-kinetic abilities. It is also correlational to an extent, as it examines the relationship between these exercises and improved performance in specific skills like the forehand smash and snatch strike.

Table 1. Shows The Homogeneity of The Research Sample Through Testing The Skewness Coefficient in Some Variables

Variables	Measuring Unit	Mean	Median	Std. Deviations	Skewness
Weight	Kg	59,81	60,40	4,39	-0,28
Length	Cm	166,0	165,0	3,46	-0,16
Age	Year	19,8	19,5	0,91	+0,41

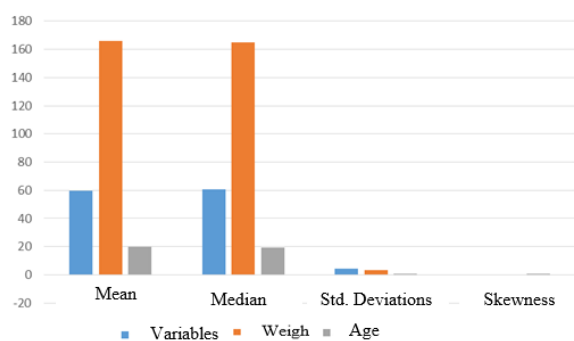


Figure 1. Shows The Homogeneity of The Research Sample Through Testing the Skewness Coefficient in Some Variables

Table 2. Shows Physical And Skill Exercises

Skill exercises	Special exercises	Weeks
The coach hits high balls, and the player hits 10 smash balls in specific areas on the court.	Standing in front of the device with arms extended, pull a rope in front of the chest at a right angle. Repeat the exercise for four sets.	first week
The coach hits high balls. The player hits 10 fastballs in specific areas on the field.	Stand in front of the device with arms extended. Pull the rope in front of the chest at a sharp angle 10 times. Repeat the exercise in four sets.	second week
The players exchange 20 smash balls in specific areas on the court.	Stand with the device behind the athlete and arms above the head. Pull the rope from behind the head in front of you 10 times. Repeat the exercise in four sets.	third week
Exchanging balls between players: 20 lightning balls in specific areas on the field.	Stand with the device behind the athlete and arms above the head. Pull the rope forward by opening the arms to the side 10 times. Repeat the exercise for four	fourth week

Then the researcher conducted, in order to ensure the homogeneity of the members of the research sample, a skewness coefficient test was used between the variables of height, weight, and chronological age. It was found that the values of the correlation coefficient were limited to (+1), and this means that the sample is homogeneous, as shown in Table 1.

Exploratory experiment

The researcher conducted the exploratory experiment on November 1, 2022, in the indoor hall of the Armenian Club in Baghdad on a sample of badminton players, during their daily training, so that the two researchers took into account the same conditions of the experiment in terms of place, time, and tools. This initial phase aimed to refine the methodology and ensure that the exercises, tools, and equipment could be applied effectively within the practical limitations of the club's environment. The exploratory experiment also helped validate the feasibility of the proposed training regimen.

Determine the most important tests

Bio-kinetic abilities related to study

- First: Compatibility test: throwing and receiving balls at the wall (Mahmoud, 2018).
- Second: Testing the speed of kinetic response: starting in the opposite direction of the signal (Ali & Qadir, 2011).
- Third: Agility test: Multi-directional running test (Hassanein, 2001);(Born et al., 2016).

Skill tests

- First: Testing the straightforward crushing blow (Hardan, 2009).
- Second: Testing the diagonal snatch forehand strike at the net (JAGE, 1982).

Main experience

Pretests

The researcher conducted the pre-tests, both bio-kinetic ability tests and skill tests, on 6/11/2022 in the indoor hall of the Armenian Club in Baghdad. The exercises used in the research: The exercises were applied to the research sample of (10) players on 13/11/2022, by the researcher for two months, with two training units per week for 8 weeks, in addition to the skill exercises applied on the field, as the training unit included exercises especially by using rubber cords for the consolidation device, in addition to skill exercises as shown in Table 2.

The coach hits high balls, and the player hits 10 smash balls in specific areas on the court.	Stand in front of the device and pull the rope from the front to the side 10 times. Repeat the exercise for four sets.	fifth week
The coach hits high balls. The player hits 10 fastballs in specific areas on the field.	Stand with the device behind the athlete. Pull the rope with one arm, right, behind, in front, 10 times. Repeat the exercise for four sets.	sixth week
The players exchange 20 smash balls in specific areas on the court.	Stand with the device behind the athlete. Pull the rope up and down next to the body 10 times. Repeat the exercise for four sets.	seventh week
The coach hits high balls. The player hits 10 smash balls in specific areas on the court	Stand with the device behind the athlete. Arms bent behind the head. Pull the rope from back to front behind the head 10 times. Repeat the exercise in four sets.	eighth week

Post-tests

After completing the exercises, the researcher conducted the post-tests on 29/12/2022 in the indoor hall of the Armenian Club in Baghdad. The researcher ensured that the tests were in the same conditions regarding time, place, and tools used in the research in which the pre-tests were conducted.

Statistical analysis

The statistical analysis was done manually and with SPSS version 14.0 for Windows. The study employed both descriptive and inferential statistical methods, including the use of the t-test to determine significant differences between the experimental and control groups in the pre- and post-tests. The acquired data was statistically evaluated using descriptive statistics like mean, standard deviation, and p-value calculation of direction. Also, the descriptive statistics were used as tables. The significance threshold was set at $p < 0.05$.

Results and discussion

Research Results

The results of data analysis show that there was an increase after being given the pre-test and post-test data treatment, in table 3, 4 and 5. To enhance the clarity of these results, it is important to interpret the numbers beyond mere presentation in tables, offering a deeper reflection on why these specific values emerged and their significance in the context of bio-kinetic abilities and skill improvements in badminton.

The results in Table 3 demonstrate that the experimental group showed significant improvement in all bio-kinetic abilities after completing the intervention program. The notable reduction in the speed of kinetic response (from 1.844 to 1.742 seconds) suggests an enhanced reac-

tion time. This is likely attributed to the specialized exercises that targeted rapid muscle response and coordination. Similarly, the significant improvement in agility (from 14.473 to 13.130 seconds) reflects better multi-directional movement efficiency, which is critical for badminton performance. Finally, the increase in compatibility scores (from 7.800 to 9.400) indicates an improvement in coordination between hand-eye movements, which is essential for precise shot placement. These findings support the hypothesis that bio-kinetic training significantly improves physical performance parameters.

The skill tests, as illustrated in Table 4, reveal significant progress in the execution of badminton strikes. The straight front smash increased from a mean score of 6.300 to 8.000, which is statistically significant. This suggests that the intervention improved the power and accuracy of smashes. Similarly, the diagonal front snap saw a significant improvement from 5.300 to 9.100. These skill-based enhancements are aligned with the observed gains in bio-kinetic abilities like coordination and agility, indicating that the physical improvements had a direct effect on skill performance.

The second experimental group, although showing improvement, demonstrated smaller gains compared to the first group. For instance, the straight front smash increased from 4.000 to 6.000, and the diagonal front snap increased from 5.700 to 7.200. These results still indicate significant improvements, but the smaller magnitude of change might suggest either a lesser degree of responsiveness to the training interventions or pre-existing differences in performance between groups. The statistical significance of these improvements confirms that the intervention had a positive impact, but the first group's larger gains could indicate differences in the intensity or adaptation to the specialized exercises.

Table 3.

Shows the arithmetic means, standard deviations, and t-value calculated for the bio-kinetic ability tests for the first experimental group.

Tests	Measuring unit	Pre-test		Post-test		T value	Level sig	Type sig
		Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation			
Speed of kinetic response	Second	1,844	0,102	1,742	0,089	7,423	0,001	Sig
Agility	Second	14,473	0,718	13,130	0,887	3,012	0,000	Sig
Compatibility	Degree	7,800	0,337	9,400	1,240	3,123	0,016	Sig

At a significance level of 05.0 and a degree of freedom of 4

Table 4.

Shows the arithmetic means, standard deviations, and t-value calculated for the skill tests for the first experimental group.

Tests	Measuring unit	Pre-test		Post-test		T value	Level sig	Type sig
		Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation			
Straight front smash	Degree	6,300	1,714	8,00	0,808	7,234	0,001	Sig
Diagonal front snap	Degree	5,300	0,453	9,10	0,456	28,00	0,000	Sig

At a significance level of 05.0 and a degree of freedom of 4

Table 5.

Shows the arithmetic means, standard deviations, and t-value calculated for the skill tests for the second experimental group.

Tests	Measuring unit	Pre-test		Post-test		T value	Level sig	Type sig
		Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation			
Straight front smash	Degree	4,00	1,471	6,000	1,760	3,372	0,011	Sig
Diagonal front snap	Degree	5,700	2,133	7,200	3,245	3,400	0,023	Sig

Discussion

According to what the results showed in Tables (5) and (6), the researcher attributes that the special exercises used by the researcher according to a device using rubber ropes had a prominent role in bringing about clear developments in some bio-kinetic abilities. However, while these results show clear improvements, it is essential to critically assess why these exercises led to significant changes in the experimental group. The increased muscle strength and agility seen in the post-test can be attributed to the specific nature of resistance training, which has been shown to improve both muscular coordination and explosive power in previous studies (Sharida, 1990). Yet, it is crucial to question whether these improvements are sustainable over the long term or are a result of short-term adaptations. This is confirmed by (Dayem, 1985): "Codified and regular training programs following scientific foundations work to develop the physical and skill level of the players" (Dayem, 1985); (Hatem, 2008).

To develop the bio-kinetic capabilities of the arms, various resistance exercises are performed from different directions, from front to back, from back to front, from the side, from above to below, and in various positions, from standing and sitting on the ground, with varying intensity depending on the intensity of the exercise and depending on the intensity to which the player has reached. These repetitions played a prominent role in increasing Pressure on the working muscles to perform exercises that require great strength and in the fastest time. This increases the connection between strength and speed over the muscle, and this ultimately benefits skill performance. There is a close connection between kinetic skills and the physical qualities that the player acquires in the training process (Abdullah, 1991); (Mahalingan, 2007); (Al-Selmi, Fenjan, et al., 2019)

"The research results: (Using the exercises and some of the dietary supplements have a positive effect on improving some of the physical abilities, speed, and accuracy of smash shot skill for badminton young players)." (Al-Selmi, Al-Shawi, et al., 2019) "The study of (Abeer et al.) confirmed the findings. Recommend the researchers: to circulate the results of the current study on the sports teams participating in the league in badminton." (Jawoosh et al., 2021); (Paramitha et al., 2020). The study of (Kzar et al., 2022) indicated "Transactional Theories and Transformational Theories). Necessary for work in colleges of physical education and sports" (46:16). The study (Gzar & Mohammed, 2021) indicated, "The results were shown that the percentage of improvement in the skill performance of Mai Geri is 100%" (Abdullah, 1991). The study (Akbar & Hatem, 2021) indicated, "The devices, tools,

and type of exercises must be compatible with the requirements of the sample." To achieve the desired goal and goal (31:18).

The study (Nassir & Hatem, 2022) indicated, "It is necessary to continue to engage in aerobic and anaerobic sports activities for women with ovarian syndrome because they have an important role in improving the functioning of functional organs, including regulating the function of building hormones" (Mahalingan, 2007). The study (Hatem & Qassim, 2020) indicated, "HIIT exercises have a positive effect on some physiological and physical indicators in reducing competition anxiety and it had the role to develop the offense skills for the players of Badminton" (360:20). The study (Nassir & Hatem, 2022) emphasized "the emphasis on implementing various training programs" (107:21). The study (Anam et al.) recommended "adopting the training curriculum on the flat pyramid method in developing strength, as well as emphasizing the use of weight exercises in training programs" (Abdullah, 1991); (Born et al., 2016). This study (Tahir & Hatim, 2023) recommended, "using Saky exercises (S.A.Q) for female runners in the 100-meter hurdles competition with the same intensity, repetitions, and inter-comfort for its role in improving the levels of biochemical variables (sodium, calcium, and enzyme (C.P.K)". The study (Mohammed et al., 2021) indicated, "The most important of which is the preference for the experimental group in the applied exercises for metacognitive education used in the educational curriculum for performance, which had an effective role among the members of the experimental group."

Conclusion

The researchers reached the following conclusions through analyzing and discussing these results:

1. The special exercises had a positive effect on the results of bio-kinetic abilities between the two groups and in favor of the experimental group that applied the exercises.
2. The special exercises had a positive effect on the results of the skill tests between the two groups and in favor of the experimental group that applied the exercises.

The researchers provided recommendations regarding future research on badminton:

1. Adopting the results of this study and disseminating them, and emphasizing the equipping of stadiums with modern training methods, due to the positive impact they achieve in physical development.
2. Need to pay attention and emphasize training using the Multi Gym device in developing other basic skills in the game of badminton.

3. Need to pay attention and emphasize strength, agility, or explosive power training to develop physical conditions in badminton.

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