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**The effect of using reflex ball on hand-eye coordination in kickboxing**

Research Project

Submitted to the department of (Physical Education and Sports Science) in partials fulfillment of the requirements for the degree of Bachelor’s in (Physical Education)

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**Abstract**

Kickboxing is a complex sport with demands comprising a number of specific characteristics to achieve a high-level competitive performance such as skill related components include speed, agility, power, balance, coordination and reaction time. Therefore, this study aims to identify the effect of using a reflex ball on hand-eye coordination in kickboxing. A total of 5 kickboxers participated in the study. The participants underwent a four-week training program using a reflex ball. The research sample was tested before and after the training program to evaluate their hand-eye coordination level. The results showed that the program training significantly improved hand-eye coordination of the players. It can be concluded that the use of a reflex ball can effectively enhance hand-eye coordination ability of kickboxing players.

**Chapter One**

1. Research Introduction
	1. Introduction and research importance
	2. Research problem
	3. Research objective
	4. Research hypothesis
	5. Research fields

# **1- Research introduction**

# **1.1 Introduction and research importance:**

Kickboxing is a combat sport which involves two competitors directing full-force strikes with the hands, elbows, knees, shins and feet at each other. Moreover, as kickboxing athletes have to perform a great number of actions during each match, the physical and physiological demands are high (Crisafulli et al., 2009, 143). Kickboxing is a dynamic, high-intensity intermittent striking combat sport that requires complex skills and tactical excellence for success where athletes are classified by gender, body mass and age categories (Buse et al. 2009, 331).

It can be established that kickboxing is a complex sport with demands comprising a number of specific characteristics to achieve a high-level competitive performance. It is well known that understanding the characteristics of elite-level athletes can provide insightful information regarding what is truly needed for competitive success (Zabukovec and Tiidus, 1995, 240). Particularly, physiological characteristics of athletes are generally measured through testing their components of fitness and skill. The fitness components include cardiorespiratory endurance, muscular strength, muscular endurance, flexibility and body composition. Skill related components include speed, agility, power, balance, coordination and reaction time. Most combat sports require a mix of technique, strength, aerobic fitness, power, and speed. Usually, no single performance characteristic dominates in combat sports (Franchini et. al., 2011, 147).

Coordination abilities, as the most important qualities in the physical preparedness of athletes specializing in martial arts, largely determine the effectiveness of the training process and participation in competitions. Recently, significant attention has been given to the understanding of the structure of Coordination Motor Abilities (CMA). The main objective of coaches and scientists is to determine the dominant role of particular abilities in different sport disciplines. It seems that CMA are of great significance in combat sports (Sadowski, 2005, 62).

The most important component of training activity is the control over the level of preparedness of athletes, which, in turn, stimulates specialists and coaches to search, develop and implement new and more effective ways to assess physical qualities and abilities in sports training. The dynamically developing type of martial arts is no exception - kickboxing, which imposes specific requirements on the technique demonstrated by athletes in complex coordination and dynamic situations of competitive activity. In addition, competitive performance in kickboxing largely depends on the speed of motor reactions, the ability to instantly make rational decisions and effectively implement them as quickly as possible (Grahov, 2022, 14). The significant of the study provided in trainings using the reflex ball which in several ways enhances improvement of dominant motor abilities of kickboxing game.

# **1.2 Research problem:**

Despite the fact that kickbox coaches depend on trainings in order to develop skills and motor abilities, and it is clear that using modern tools and devices take an efficient role in this development. Throughout the researchers’ reservation to kickboxing players, it is noticed that there are several essential motor abilities require improvement such as quickness and motor abilities and skill coordination, and there was a lack of utilizing modern tools in order to raise the level of performance in training sessions. Therefore, the researchers provided a modern tool (reflex ball) in which reported that it assists in improving several fitness components, skills and motor abilities as an attempt to boost the process of improving coordination of kickbox players.

# **1.3 Research objective:**

* Identify the effect of using reflex ball on coordination for kickbox players.

# **1.4 Research hypothesis:**

* There is a statistically significant difference between pre and post tests for kickboxing players.

# **1.5 Research fields:**

1-5-1 human field: senior male kickbox players of Qala sport club.

1-5-2 time: form 1/11/2022 until 1/5/2023

1-5-3 place: Dana kickboxing hall.

**Chapter Two**

2. Theoretical and similar studies

2.1 Kickboxing

2.2 Physical and physiological demands of kickboxing

2.3 Eye-hand coordination

# **2. Theoretical and similar studies:**

# **2.1 Kickboxing:**

Kickboxing is a combat sport which involves two competitors directing full-force strikes with the hands, elbows, knees, shins and feet at each other. Styles such as Muay Thai, American or European kickboxing, Chinese San Shou, and French Savate seem to have evolved independently and asynchronously from each other. A typical kickboxing competition contains 3 to 12 rounds of 2 to 4 min each with a rest period of 1 to 2 min in between (Buse GJ, 2009, 331). Typically, kickboxing medalists perform five to seven matches during international competitions, with each match having an 8-min time limit, the match is finished only when one of the athletes scores; if no one succeeding in scoring an additional round should be added). Moreover, as kickboxing athletes have to perform a great number of actions during each match, the physical and physiological demands are high (Crisafulli et al, 2009, 143). Kickboxing is a dynamic, high-intensity intermittent striking combat sport that requires complex skills and tactical excellence for success where athletes are classified by gender, body mass and age categories. International level competitions have the following age categories: juniors: 16 to 18 years old; pro-seniors: 19 to 40 years old; veterans: 41 to 50 years old. In regional, national, and international events, there are seven official senior female weight divisions (i.e., ranging from <48 to >70 kg: “light” (<48, <52, and <56 kg), “middle” (<60, and <65 kg), and “heavy” (<70, and >70 kg)) and twelve official weight divisions for both junior and senior male kickboxers (i.e., ranging from <51 to >91 kg: “light” (<51, <54, <57, and <60 kg), “middle” (<63.5, <67, <71, and <75 kg), and “heavy” (<81, <86, <91, and >91 kg)) (Buse GJ, 2009, 331). the main goal of kickboxing training is to prepare the kickboxers to effectively manage both the technical, tactical and the physiological demands of combat. To be effective, kickboxing techniques should be applied with

accuracy, within a good ‘window of opportunity’, with strength, velocity and power (Buse GJ, 2009, 332).

# **2.2 Physical and physiological demands of kickboxing:**

Preceding reports in kickboxing use theories and frameworks of experimental and descriptive research performances in evaluations and tournaments analysis, which are determined by a competitor’s anthropometric, technical, tactical, psychological, physical and physiological characteristics (Ouergui et al, 2013, 294). For instance, from the physical conditioning perspective, the main goal of kickboxing training is to prepare the kickboxers to effectively manage both the technical, tactical and the physiological demands of combat. To be effective, kickboxing techniques should be applied with accuracy, within a good ‘window of opportunity’, with strength, velocity and power (Buse GJ, 2009, 332). As in Muay Thai, this short burst of energy is supplied mainly by anaerobic metabolism. In contrast, the maintenance of the intermittent work performed during a match, as well as the recovery process during the short intervals, is mainly supported by aerobic metabolism. Additionally, aerobic metabolism is especially important for effective recovery between matches (Crisafulli et al, 2009, 143). Poor anaerobic or aerobic capacity is of concern, for the unconditioned, inexperienced competitor and therefore less technical skills and physical profile may be related to increased risk of injury (Buse GJ, 2009, 333). Nevertheless, prolonged periods of kickboxing training each week and/or overtraining condition might increase the risk of traumatic brain injury (TBI). It can be established that kickboxing is a complex sport with demands comprising a number of specific characteristics to achieve a high-level competitive performance. It is well known that understanding the characteristics of elite-level athletes can provide insightful information regarding what is truly needed for competitive success (Zabukovec R, Tiidus PM, 1995, 240). Particularly, physiological characteristics of athletes are generally measured through testing their components of fitness and skill. The fitness components include cardiorespiratory endurance, muscular strength, muscular endurance, flexibility and body composition. Skill related components include speed, agility, power, balance, coordination and reaction time. Most combat sports require a mix of technique, strength, aerobic fitness, power, and speed. Usually, no single performance characteristic dominates in combat sports. Psychological skills are the most important factors that are related to performance for most sports such as motivation, self-confidence, and mental toughness. Therefore, it is important for coaches, trainers, and sports scientists to collect objective information about their kickboxers’ main physical, physiological and psychological characteristics to improve training organization, establishing short- and long-term training goals, to provide objective and accurate feedback and to motivate athletes during training. In this review, the aerobic and anaerobic power and capacity as well as strength (strength, endurance, muscle power and maximal strength) characteristics of amateur and elite kickboxers are presented (Franchini et al, 2011, 147).

# **2.3 Eye-hand coordination:**

Eye-hand coordination is a skill that can be trained and may contribute to increasing the player’s motor potential (Vine, Wilson, 2011, 340). It can also influence movement efficiency and thus improve the player’s performance in competitive circumstances. In many sports, the players are required to perform specific activities which require physical exertion of variable intensity. At the same time, the performed motor activities must be executed precisely and as quickly as possible. Thus, one may say that high level skills in recognizing and processing information and generating movement produce better results. This is how the feedback system works (Crawford et al., 2004, 10). This thesis has been confirmed in studies that proved that movement is initiated with a retinal image and ends with muscle stimulus (Batista et al., 1999, 257). Thus, creating a situation in which the eye is repeatedly exposed to external stimuli results in reaction time reduction. On the other hand, however, prolonged nervous system load by effort with repeated repetitive stimuli causes nervous system fatigue. Gandevia presented results suggesting that during fatigue efforts, focal lesions in excitability of the cerebral cortex and inhibition based on electromyographic (EMG) records were revealed. The researcher suggestion is also Human fatigue is not simply muscle (Gandevia, 2001, 1725).

**Chapter Three**

3. Research curriculum and field procedures

3.1 Research curriculum

3.2 Research population and sample

3.3 Sample homogeneity

3.4 Data collection tools

3.5 Instruments and tools

3.6 Coordination test

3.7 Exploratory experiment

3.8 Pre-test procedure

3.9 Application of using the reflex ball

3.10 Post-test procedures

3.11 Statistical tools

# **3. Research curriculum and field procedures:**

# **3.1 Research curriculum:**

The experiment design with pre and post tests is used which appropriates with the nature of the study.

# **3.2 Research population and sample:**

The research population will consist of senior male kickboxing players of Qala Sport Club numbered (8) individuals, the exploratory experiment applied on (3) participants and the remaining (5) players represent the study sample.

# **3.3 Sample homogeneity:**

The researchers applied the homogeneity of (age, mass, height and years of playing) variables for sample individuals in order to avoid the effect of the above variables on study results. the results illustrated in a table (1).

Table 1: Homogeneity of the research sample

|  |  |  |
| --- | --- | --- |
| **n** | **variables** | **sample** |
| **mean** | **s.d** | **skewness** |
| 1 | Age (years) | 21.5 | 2.52 | 0.91 |
| 2 | Mass (kg) | 67.75 | 2.44 | 0.86 |
| 3 | Height (cm) | 172.25 | 9.22 | -0.60 |
| 4 | Exercise age (month) | 54 | 4.04 | 0.91 |

# **3.4 Data collection tools:**

The following tools are used for data collection:

* Questionnaire form of appropriate physical tests (appendix 1).
* Personal appointments.
* References.
* Measurements of (height, weight and age).

**3.5 Instruments and tools:**

The following tools and instruments are used:

* Weight scale.
* Laptop (Dell).
* Kickboxing ring (indoor hall).
* Stop watch (2).
* Tennis ball.
* Score sheets.

# **3.6 Coordination test:**

Due to lack of eye-hand coordination tests in the field of martial art, the researchers intentionally selected the below test in order to measure coordination level of research sample players. This test is worldwide used in numerous articles developed by (Ellison) in Hull University – United Kingdom.

**Objective:**

The test's objective is to monitor the ability of the athlete's vision system to coordinate the information received through the eyes to control, guide, and direct the hands in the accomplishment of catching a ball (hand-eye coordination).

**Required Resources:**

To conduct this test, you will require:

* Tennis Ball
* Stopwatch
* Smooth Wall
* Assistant

**How to conduct the test:**

This test requires the athlete to throw and catch a tennis ball off a wall.

* The athlete warms up for 10 minutes
* The athlete stands two meters away from a smooth wall
* The assistant gives the command "GO" and starts the stopwatch
* The athlete throws a tennis ball with their right hand against the wall and catches it with the left hand, throws the ball with the left hand and catches it with the right hand. This cycle of throwing and catching is repeated for 30 seconds
* The assistant counts the number of catches and stops the test after 30 seconds
* The assistant records the number of catches (Ellison, 2015,66).

# **3.7 Exploratory experiment:**

The exploratory experiment conducted on (Tuesday 17/1/2023) (3) players from research population in order to verify the following:

* Validity of the equipment and tools used.
* Tests appropriateness with participants’ level.
* Time period for each test and for the total procedure.
* Identify any further difficulties faces researchers during procedure and attempting to avoid them.

# **3.8 Pre-test procedure:**

Pre-tests is conducted on (Wednesday 18/1/2023 – 4pm) on the research sample to determine the level of hand-eye coordination of the study sample at Dana sport hall in Daratu - Erbil.

# **3.9 Application of using the reflex ball:**

The reflex ball is used for a total of (4 weeks) within (3) training session per week (12 training sessions in total). In each session the ball is used for a period between (10 – 15 minutes). The researchers did not prepare training program for players to practice, the coach training program remained and followed by participants only the reflex ball was added to players’ exercise schedule (appendix 1). Ball trainings were under supervision of the coach, during practice time with the ball instructions were given in order to improve players skills and movements.

# **3.10 Post-test procedures:**

Post-test is conducted on (Monday 20/2/2023 – 4pm) on the research sample at Dana sport hall and under the same conditions of pre-tests in order to identify the effect range of using reflex ball on hand-eye coordination for study participants.

# **3.11 Statistical tools:**

The statistical package of social sciences (SPSS) will be used to analyze the data by using the following formulas (mean, standard deviation, percentage, paired sample t-test).

#

Chapter Four

4. Illustration and analyzing of the results

4.1Illustration and analyzing if pre and post test results

# **4. Illustration and analyzing of the results**

**4.1 Illustration and analyzing of pre and post test results:**

Table 2: Pre and post results eye-hand coordination tests

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| n | variables | Measurement unit | Pre test | Post test | T value | P value | Sig |
| mean | s.d | mean | s.d |
| 1 | **Eye- hand coordination** | second | 14.75 | 3.40 | 20.75 | 3.86 | 6.57 | 0.01 | **significant** |

Graph 1: The difference between pre and post tests of coordination level for sample players

Table (2) shows the mean and standard deviation of the sample in pre and post tests for eye-hand coordination, pre-test mean and standard deviation was (14.75 and 3.40) respectively, and post-test values were 20.75 and 3.86) respectively. The (p value) was (0.01) which is smaller than (0.05) mean there are significant differences between pre and post in speed test for sample in eye-hand coordination test.

Kick boxing is a combination of technical and tactical, durability, speed, and coordination features as well as to the basic characteristics of the fist. Success will be achieved with the completion of these features in addition to development of general training programs by used decent training methods and equipment (Çetin, 2018, 115).

The aim was to study the effect of using reflex ball on eye-hand coordination for kickboxing players. Evidence indicating that reflex ball training improves eye-hand coordination of the study participants. This motor ability can be trained and may contribute in increasing players’ motor potential as well as movement efficiency and performance in competition (Lenik, 2017, 355). the results of the study show that training on reflex ball significantly assist in shaping the eye-hand coordination. The researchers report that ball training as a whole can lead to better motion skills and reduce time to react to a stimuli which in this case is the reflex ball used by players led to quicker response to the ball in addition to faster fist and upper body movements and made players to change fist and body rapidly toward directions of the ball. Another possibility for the effect of the reflex ball might be visual training has positive effects on eye-hand coordination (Du Toit et. al., 2011). When players trained with the reflex ball, they had to kick the ball to different direction and heights, therefore, the players had to be ready and anticipate all possibilities in terms of the return direction of the ball and how fast the ball comes back, thus type of training led to develop coordination and players skill to react more rapidly and apply movements according the circumstances and game demands.

**Chapter Five**

5. Conclusion and recommendations

5.1 Conclusion

5.2 Recommendations

# **5. Conclusion and recommendations:**

# **5.1 Conclusion:**

* Exercise with the reflex ball significantly improved the level of eye-hand coordination for kickboxing players.

# **5.2 Recommendations:**

* Using the reflex ball in combat games which has an efficient effect in increasing coordination features.
* Conducting similar studies to determine the effect of the reflex ball on other motor abilities such as agility, balance and reaction time.
* Conducting further studies on age groups and gender.

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# **Appendix 1**

**This appendix shows a training unit applied on research sample by using the reflex ball**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| N | Exercise  | Duration (minute) | repetition | description |
| 1 | Warmup | 15 |  | -The reflex ball is used for total of (4 weeks) within (3 training) session per week (12 training session in total).- In each session the ball is used for a period between (10-15 minutes). |
| 2 | Muscle relaxation  | 5 |  |
| 3 | Push up |  | 100 |
| 4 | Weightlifting  | 10 |  |
| 5 | Shadow boxing | 5 |  |
| 6 | Pad training | 5 |  |
| 7 | Punching bag | 4-5 |  |
| 8 | Reflex ball | 10-15 |  |
| 9 | Kickboxing bout | 5 |  |