The Impact of Cross-Training on Some Specific Physical Capacities and the Effectiveness of Some Complex Skill Performances in Female Karate Kumite Athletes in Sohag Governorate

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Introduction and Problem of the Study:

Sports training, in its various forms, has become an essential process with an important role in modern societies. It has become a field of competition among all segments of society. Sports training is considered the primary means to meet the requirements of sports activities and to develop them in line with the desired goal. As the level of competition between individuals advances, the need to adopt modern training methods to enhance these levels increases.

Cross-training is one of the modern trends in sports training. "Wafaa Sabah Mohamed" (2010) cited from Mcglynn (1997) and Moran (1997) defined cross-training as a training program designed for different activities and sports, providing variety to reduce the risk of injuries. The diversity in practicing other sports and activities enhances performance in the specialized sport. This view was supported by "Omar Nasr Allah Qeshta" (2011), who noted that reaching high levels and participating international in local and championships requires athletes to spend thousands of hours in complex training and exercises to develop their capabilities. Without diverse and connected training plans, athletes often find it difficult to adapt physically and psychologically, which can lead to physical and mental stress. Most sports teams undergo various training methods aimed at exerting maximum effort from players in their specific sports, such as hockey, handball, and basketball.

"Amira Hassan, Maher Hassan" (2008) also mentioned that a successful coach is one who plans a diverse training program to stimulate the interests and motivations of the athletes. This diversity and change include altering the nature of the exercises, changing the training environment, or changing the times of daily training sessions.

Jack H. Wilmore and others (2008) explained that cross-training is "training in more than one sport simultaneously or training different fitness elements such as endurance, strength, and flexibility at the same time."

Bryant Stamford (1996) stated that cross-training represents "a strategy for organizing performance either in a single training session or distributed across consecutive sessions, providing as many varied activities as possible while ensuring proper sequencing."

Therefore, cross-training can be considered an integrated training tool

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that helps athletes in specialized sports to compete better.

In light of the above, the researcher believes that cross-training is a method that includes various sports activities designed in a way that suits the sport's effectiveness. Its aim is to improve physical, skill, and tactical levels through the use of various sports equipment. and activities. and techniques related to the specialized sport. This approach provides enjoyment and excitement, which enhances the athlete's psychological state, increases motivation during training, and reduces the chances of injury, thus positively affecting performance.

Ahmed Mahmoud Ibrahim (1991) mentioned that karate, like other has different sports, competitions, each with its own characteristics. There are kumite (actual fighting) and kata (patterns of movement) competitions, as well as individual and team events for both males and females.

Ahmed Mahmoud Ibrahim (1995) also explained that karate is an individual combat sport characterized by a variety of techniques and numerous basic offensive moves such as punching, striking, and kicking. Karate requires a high level of skill in selecting appropriate movements through coordination, speed, agility, and flexibility.

Mohamed Said Abu-Nour (2002) pointed out that modern training methods for real combat skills in karate depend on the speed of transition from one position to another, linking offensive skills in a coordinated manner as a sequence of moves, whether punches, kicks, or combinations.

Ibrahim Abdul-Hamid Al-Ebari (2007) mentioned that regular and continuous voluntary training with offensive skill sequences according to various situational possibilities is effective in competitions. This allows the athlete to react quickly and correctly, and also to perform new offensive skill sequences as part of the offensive strategy.

Through the previous review, and after observing and following up on the Egyptian Karate Federation tournaments in Sohag for the female kumite competitions, the researcher noticed deficiencies in some complex skill performances during matches. Many of these skills failed to break through the opponent's defense and did not achieve their intended goals, which directly affected the tactical effectiveness during the matches. As a result, many matches ended without six-point achieving а difference between the competitors, as stipulated in the International Karate Federation's rules. This observation led the researcher to explore training methods that could improve complex skill performances among female kumite athletes, prompting the use of crosstraining.

Objective of the Study:

The current study aims to examine the impact of cross-training on certain specific physical capacities and the effectiveness of some complex skill performances in female kumite athletes in karate in Sohag Governorate.

Research Hypotheses:

-There are statistically significant differences between the pre-test and post-test mean scores for specific physical capacities and complex skill performances in the experimental group in favor of the post-test.

-There are statistically significant differences between the pre-test and post-test mean scores for specific physical capacities and complex skill performances in the control group in favor of the post-test.

-There are statistically significant differences between the post-test mean scores for specific physical capacities and complex skill performances between the experimental and control groups in favor of the experimental group.

Terminology of the Study: Cross-training:

Using another sport or training technique to help improve performance in the primary sport or activity being practiced.

Complex skill performances:

The ability of the athlete to penetrate the opponent's defense by executing a series of complex skills that are prepared and arranged according to specific movement and tactical goals based on the situations encountered during kumite matches.

Kumite competition:

A match between two athletes who are evenly matched in weight, grade, age group, and gender, where each tries to score points by attacking the opponent within the areas authorized by the rules of the game.

Methods and Procedures of the Study:

Research Methodology:

The researcher used the experimental method with a "one experimental group design" using preand post-tests, as it is suitable for the nature of the study.

Study Population:

The study population includes female karate athletes from Sohag Youth Center, who have achieved black belt Dan (1) or higher, totaling 36 athletes registered with the Egyptian Karate Federation for the 2023/2024 sports season.

Study Sample:

A purposive sample of 20 female karate athletes (under 15 years old) with black belt Dan (1) or higher from Sohag Youth Center, registered with the Egyptian Karate Federation for the 2023/2024 sports season, was selected for the study.

Data Collection Tools:

The researcher used the following tools and devices to collect data for the study:

A. Review of Scientific References and Previous Studies:

The researcher reviewed scientific references and previous studies in the field of sports training, such as (2) (7) (9) (12) (20) (27), and in the field of karate, such as (1) (5) (6) (8) (13) (21) (24), to understand the studies that focused on cross-training as well as those that addressed the performance levels of complex skills in karate athletes.

B. Observation:

-The researcher identified the research problem through scientific observation.

C. Personal Interviews:

-The researcher conducted personal interviews with 10 experts to seek their opinions on the questionnaire forms for physical tests and the effectiveness of complex skill performances, as well as

to determine the components of the proposed training program. (See Attachment 1)

D. Expert Opinion Questionnaires Used in the Study:

-The researcher designed a registration form for the data of the female athletes, including (name, age, height, weight, training age). (See Attachment 2)

-The researcher designed a form to determine the complex skill performances of female kumite athletes. (See Attachment 2)

-A questionnaire for expert opinion on determining the components and time periods of the training program using cross-training. (See Attachment 4)

E. Physical Tests Used: (See Attachment 5)

-Standing long jump

-Trunk flexion from a standing position

-Nelson's test for movement and transition speed

F. Measurement of Complex Skill Performances (See Attachment 6):

The level of complex skill performances was measured by having the athletes participate in five matches, each with a specific offensive task (complex skill performances) against players of the same age and weight category from a competing club. The match duration was two minutes, during which each athlete attempted the complex skill performance 10 times. The number of successful complex skill performances for each athlete was recorded in a prepared registration form.

Exploratory Study:

The researcher conducted an exploratory study on a sample from the

research population outside the main sample, consisting of 16 athletes. This was done to perform the scientific procedures for the physical and skill tests used and to assess their suitability for the current study.

Scientific Validity Used in the Study: Validity:

The researcher used discriminative validity by finding the differences between two groups: one distinctive group consisting of 8 athletes and a non-distinctive group of 8 athletes. The researcher calculated the significance of the differences between the two groups to verify the validity of the tests.

Reliability:

The researcher used the Test-Retest method with a time interval of five (5) days between the first measurement and its reapplication on the non-distinguished group (8 junior participants) from the research population but outside the main research sample.

Cross-Training Program

Development of the Training Program

The researcher consulted various specialized references in karate and sports training to determine the elements of the training program (Appendix 6), including:

- Program duration

- Number of weekly training sessions
- Training session duration
- Load cycle

- Appropriate general physical training methods

These elements were then reviewed by experts to ensure their

suitability for the age group under study.

Steps in Designing the Training Program

The researcher developed skillbased exercises related to the complex skill performances under study through the following steps:

1. Identifying the muscles and joints involved in the study using scientific references.

2. Designing exercises that develop the targeted muscles and joints with input from experts to ensure a positive impact on research variables.

3. Applying some exercises to the sample to determine the appropriate training load.

4. Determining the percentage of exercise intensity within the proposed training program.

Objectives of the Cross-Training Program

The proposed training program aims to improve the level of complex offensive skill performances among junior kumite athletes in karate in Sohag Governorate.

Principles of the Proposed Training Program

The researcher used scientific principles and fundamental concepts in designing the training program, based on expert opinions, scientific references, and previous research in sports training. The key principles include:

- Achieving the program's intended objectives.

- Considering the age characteristics and individual differences of the sample. - Ensuring the program is appropriately structured during its application.

- Establishing a clear implementation timeline.

- Defining the main components of the training program.

- Determining the content distribution of the training program.

- Ensuring safety and security measures are met.

- Applying progressive overload from easy to difficult.

- Designing training sessions according to available resources.

- Properly structuring training loads, repetitions, sets, and rest periods between exercises.

Training Program Structure Training Period

The program lasts for eight (8) weeks, divided into three phases:

1. General Preparation Phase (2 weeks) \rightarrow 1 high-load week + 1 moderate-load week

2. Specific Preparation Phase (4 weeks) \rightarrow 3 high-load weeks + 1 moderate-load week

3. Pre-Competition Phase (2 weeks) \rightarrow 1 high-load week + 1 moderate-load week

Number of Training Sessions

- Four (4) sessions per week for the research sample.

- Total sessions over 8 weeks: 32 sessions.

-Total training time: 48 hours.

Training Session Duration

- Total session duration: 90 minutes, divided into:

- 15 minutes \rightarrow Warm-up

- 65 minutes \rightarrow Main session (physical and skill training)

- 10 minutes \rightarrow Cool-down

- Total program duration: 2,880 minutes (8 weeks × 4 sessions × 90 minutes).

- Program duration excluding warm-up and cool-down: 2,080 minutes (8 weeks× 4 sessions × 65 minutes).

Training Methodology

- The research sample applied the proposed training program using interval training (low and high intensity).

- The core exercises were selected based on similar studies and expert opinions.

- The program included 60 exercises, divided into three parts per session:

Training Session Breakdown

1. Warm-up (15 minutes)

All participants performed warm-up exercises to prepare the cardiovascular and respiratory systems, focusing on flexibility and stretching exercises.

- Activities included: jogging, walking, cycling, and stair climbing.

2. Main Training (65 minutes)

This segment focused on physical and skill training using cross-training techniques to prevent monotony.

- Exercises included: aerobic training, agility drills, cycling, treadmill exercises, and sports activities such as volleyball and basketball.

- A key objective was to enhance complex skill performance in kumite.

3. Cool-down (10 minutes)

- Included relaxation exercises to reduce physical and psychological stress.

- Focused on:

- Recovery exercises for muscle relaxation.

- Positive and negative flexibility exercises.

Load Cycle Formation

According to Mohamed Hassan Allawi (1994), daily training with a moderate load does not lead to a improvement permanent in an individual's performance level. Instead, using varying training loads in a structured manner results in faster and more consistent progress. The wavelike method is considered the most effective approach for structuring training loads within a weekly cycle. This method involves alternating between high and low loads throughout the weekly training sessions (Allawi, 1994, p. 64:18).

Based on this, the researcher structured the periodic load cycle using a 1:2 ratio, meaning one low-load session followed by two high-load sessions within the eight-week training cycle. This wave-like approach helps maintain training consistency while preventing overtraining. The same 1:2 ratio was applied within each weekly cycle, ensuring a balanced load distribution across training phases.

Training Program Content

The training program included a combination of physical and skillbased exercises aimed at enhancing specific physical abilities and complex skill performances using cross-training techniques and activities.

Program Evaluation Methods

The program was evaluated by comparing pre- and post-test results for both physical fitness abilities and complex skill performances among the research sample. The results were statistically analyzed to determine the effectiveness of the proposed training program on the studied variables.

Tools and Equipment Used in the Training Program Anthropometric Measurement Tools

- Restameter for height measurement

- Medical scale for weight measurement (kg)

- Measuring tape

- Data recording cards

Skill Performance Equipment

- Karate mats

- Cones

- Hurdles

- Punching bags

- Official kumite targets

- Flags

- Colored plastic hoops

- Measuring tape (cm)

- Markers

- Stopwatch

- Colored adhesive tapes

Research Implementation Procedures 1. Pre-Testing

The researcher conducted pretest measurements for the study variables on the research sample on December 25, 2024. These tests included assessments of:

- Specific physical fitness abilities

- Complex skill performance levels

2. Training Program Implementation

The researcher applied the crosstraining program to the study sample from Sunday, January 8, 2024, to Thursday, February 23, 2024. The program lasted eight (8) weeks, with four (4) training sessions per week, totaling 32 sessions.

- Each session lasted 65 minutes.

- The researcher ensured:

- Consistent training days, times, and locations for the research sample.

- Uniform pre- and post-test measurement methods.

- Direct supervision of the training sessions.

3. Post-Testing

After completing the training program, post-test measurements were conducted on Sunday, February 26, 2024, under the same conditions as the pre-tests. These tests re-evaluated:

- Specific physical fitness abilities

- Complex skill performance levels

Statistical Analysis Methods

To analyze the research results, the following statistical techniques were applied:

- Mean value

- Percentage analysis

- Skewness coefficient

- T-Test for statistical significance

- Standard deviation

- Correlation coefficient

Results Presentation and Discussion

In line with the research objectives hypotheses, and the findings researcher presents the obtained through statistical analysis, ensuring alignment with the research framework and hypotheses.

Discussion of the First Hypothesis

The first hypothesis states that statistically significant differences exist between pre-test and post-test mean scores for specific physical abilities and complex skill performances among the experimental group, in favor of the post-test results.

reveals statistically significant differences between the pre-test and post-test mean scores in certain physical abilities (speed-strength, flexibility, motor speed) and the level of complex skill performances, favoring the post-test results in the experimental group. The calculated "t"

values ranged between (7.66 - 10.62), which is greater than the tabulated "t" value at the 0.05 significance level.

The researcher attributes this improvement in physical abilities and complex skill performances in the experimental group to the application of the proposed cross-training program, which included various physical and skill-based exercises. This program incorporated specialized exercises targeting physical and skillbased abilities (muscular power, speed, flexibility, and complex skill performances), leading to enhanced physical abilities and skill development among young female karate athletes. The program's structured and consistent training played a crucial role in this improvement.

Zaki Mohamed Hassan (2004) stated that cross-training is a modern organizational approach that utilizes diverse activities and unconventional methods to enhance physical abilities, ultimately improving athletic performance by providing movement experiences that contribute to skill and tactical development (9:13).

Additionally, Ahmed Mahmoud (1991) noted that karate, like any sport, has multiple competition formats, each with distinct characteristics. These include Kumite (actual combat) and Kata (pre-arranged movement sequences), as well as individual and team competitions for both male and female athletes (2:28).

The researcher believes that the different muscular strength demands in various sports activities lead to variations in how muscular strength is developed. The requirements for

muscular strength vary by activity, with increased importance in sports that involve pushing or jumping.

Abu Alaa Abdel Fattah and Mohamed Sobhi Hassanein (1997) emphasized that muscular strength is a fundamental component in various sports activities, such as jumping, throwing, and hurdling in track and field, as well as shooting, jumping, and passing in basketball and handball (3:302).

Both Imad Al-Sarras (2001) and Wagih Shamandi (1993) agree that speed-strength, flexibility, agility, and reaction speed are essential physical abilities for karate athletes to achieve high performance levels (36:13) (25:18).

Flexibility is also considered a preventive and therapeutic ability, as development is crucial for enhancing all physical capacities and preventing injuries during movement execution (17:45). The researcher views flexibility as a fundamental physical and motor ability for effective movement execution in various sports skills. It represents the range of motion one or multiple joints and in contributes to energy efficiency during physical activity.

Wagih Shamandi (1993) highlighted that flexibility is a vital physical attribute in karate, particularly for executing technical and tactical movements. Athletes need sufficient flexibility to perform leg and arm movements efficiently, as seen in sidekicks, circular kicks, and torso rotations required for strong and fast punches in both Kata and Kumite performances (11:25).

Mohamed Hassan Allawi (1997) indicated that insufficient flexibility negatively impacts strength, speed, coordination, and skill execution, increasing the risk of muscle and ligament injuries (22:247).

Abu Alaa Ahmed Abdel Fattah and Mohamed Sobhi Hassanein (1997) defined speed as a complex functional component that enables an individual to perform movements in the shortest possible time. Speed is influenced by both the nervous system and muscle fibers, with speed training aiming to enhance the efficiency of both systems (3:187).

Wagih Shamandi (1993) noted an increasing interest among sports professionals in studying various aspects that contribute to athletic capabilities. performance. Physical including strength, speed, agility, and flexibility, play a crucial role in achieving high athletic performance levels by improving an athlete's physical and motor condition for training and competition (263:25).

Isam El-Din Abdel Khaleq (2003) explained that physical preparation is a key factor for success in sports performance and is the foundation for achieving high athletic levels. Special physical preparation focuses on developing the physical attributes necessary for a specific sport, aiming to maximize performance potential (12:120).

The findings of this study align with previous research by Mohamed Hussein Ahmed Juweid (2004), Mohamed Lotfi El-Sayed, Mohamed Hassan Mohamed (2002), and Breslin Mese (1999), all of whom concluded that training programs positively impact the development of various physical abilities.

Mohamed Juweid (2004)described cross-training as an organizational method in sports that multiple training integrates activities and sports related to the specialized sport being practiced. It enhance overall aims to fitness components through diverse equipment, tools, and modern training techniques (20:7).

Second: Presentation and Discussion of the Results of the Second Hypothesis

There are statistically significant differences between the mean scores of the pre- and post-measurements in the level of specific physical abilities and some complex skill performances among the control group members, in favor of the post-measurement.

shows statistically significant differences between the pre-test and post-test mean scores in physical (speed-strength, flexibility, abilities motor speed) and complex skill performances in the control group, favoring the post-test results. The calculated "t" values ranged between (2.65 - 6.85), exceeding the tabulated "t" value at the 0.05 significance level. The researcher attributes the relatively lower improvement in the control group's physical and skill performances to the absence of the cross-training proposed program. which included specialized physical and skill-based exercises.

Mohamed Juweid (2004) emphasized that cross-training is designed to improve training components by

incorporating diverse activities and modern training techniques (20:7).

Abu Alaa Ahmed Abdel Fattah and Mohamed Sobhi Hassanein (1997) stated that improving physical fitness requires training across all physical attributes, as they collectively contribute to performance enhancement and high achievement levels (3:19,20).

Mohamed Lotfi El-Sayed and Ashraf Mohamed Zain (2003)highlighted that cross-training positively psychological impacts aspects by eliminating monotony, enhancing training motivation, and promoting adaptation to diverse training environments (23:382).

Isam Abdel Khaleq (2003)pointed out that an athlete's physical condition directly influences their ability to perform sport-specific movements effectively, emphasizing the importance of endurance and agility in executing repeated movements with high efficiency (12:6).

The researcher believes that cross-training in the proposed program had a significant impact on developing the physical abilities under investigation.

Bryan and Stamford (1996) stated that cross-training leads to a significant improvement in aerobic and anaerobic endurance, muscular strength endurance, flexibility, and agility, all of which contribute to enhancing the level of performance in the practiced activity (32:4).

The researcher attributes these results to the fact that the proposed program led to improvements in the results of skill performance tests and specific physical abilities.

Awis Al-Jabali (2003)mentioned that achieving high athletic levels is not only linked to the training process and various preparation programs but also extends to include specific predispositions and motor and abilities physical present in individuals. These abilities and special talents can be guided and nurtured to achieve the general objectives of practice and enable individuals to reach the highest possible athletic levels, which has now become the first step in the selection process (16:467). Third: Presentation and Discussion of

the Results of the Third Hypothesis There are statistically significant differences between the mean scores of the post-measurements in the level of specific physical abilities and some complex skill performances among the experimental control and group members, in favor of the postmeasurement of the experimental group.

there are statistically significant differences between the mean scores of the post-measurements in the level of certain specific physical abilities (speed-strength, flexibility, and motor speed) and the level of complex skill performances among the control and experimental group members, in favor of the post-measurement of the experimental group. The calculated tvalue ranged between (2.88 - 5.69), which is greater than the tabulated tvalue at a significance level of 0.05.

The researcher attributes these differences and improvements in the level of specific physical abilities and

complex skill performances in the experimental group, compared to the control group, to their engagement in the proposed cross-training program. This program incorporated various physical and skill-based exercises, including specialized drills targeting specific physical and skill-related abilities (muscular power, speed, flexibility. and complex skill performances). exercises These contributed to the enhancement and development of specific physical abilities and skill levels among young female karate athletes. The program included unique exercises, and the structured and continuous training using both physical and skill exercises had a significant impact on improving the physical and skill abilities of the research sample.

Zaki Mohamed Hassan (2004) stated that cross-training is considered one of the modern organizational methods that utilize diverse activities and unconventional means to develop physical abilities, aiming to enhance sports performance by providing movement experiences that contribute to improving skill and tactical aspects (9:13).

Additionally, Ahmed Mahmoud (1991) noted that karate, like any other sport, includes multiple competitions, each with its distinct characteristics. These competitions include actual combat (Kumite) and choreographed movement sequences (Kata). Furthermore, there are both individual and team championships within each competition, with separate events for males and females (2:28). Both Imad Al-Sars (2001) and Wagih Shamandi (1993) agree that speedstrength, flexibility, agility, and reaction speed are the most essential physical abilities a karate athlete must possess at a high level, as they are fundamental to achieving elite sports performance (36:13) (25:18).

Mohamed Juweid (2004) defines cross-training as an organizational framework for training methods. techniques, and tools that involve practicing various activities and sports related to the specialized discipline. The goal is to enhance overall training status by incorporating multiple training devices, tools, and modern technologies in sports training (20:7). Physical preparation, in both its general and specific aspects, is one of the fundamental pillars on which skill development in various sports activities depends. There is a positive correlation between physical preparation and the accuracy of skill performance, although the strength of this relationship varies depending on the type and nature of the practiced sport (4:107).

Mohamed Hassan Allawi (1992) emphasized that an athlete cannot master the fundamental motor skills of a specialized sport without possessing the necessary physical attributes. This indicates a strong connection between physical fitness and skill performance levels (17:91,92).

Furthermore, Sayed Abdel-Maqsoud (1995) stated that the primary objective of training is to achieve a high level of sports performance. Since performance is a combination of multiple factors

referred "performanceto as determining elements," achieving excellence requires coaches to analyze the sport itself, assess the athlete's training condition before starting a new training phase, and align various training procedures accordingly. This includes setting training objectives, establishing performance standards, planning training and competitions, monitoring performance levels during matches, tracking training status, and ultimately evaluating progress to desired achieve the level of performance (10:17,18).

Conclusions:

In light of the research objectives and hypotheses, within the limits of the research sample, and based on the collected data and statistical analyses, the following conclusions were drawn:

• The training program using cross-training has a positive impact on improving the level of specific physical abilities (speed-strength, flexibility, and motor speed) among young female karate athletes (experimental group).

• The training program using cross-training has a positive impact on improving the level of complex skill performances among young female karate athletes (experimental group).

• There were minor differences between the mean scores of pre- and post-measurements in the level of specific physical abilities and some complex skill performances in the control group.

• There were statistically significant differences between the post-measurement scores of the experimental and control groups in

terms of specific physical abilities and complex skill performances, in favor of the post-measurement of the experimental group.

Recommendations:

In light of the research community, the selected sample, the research objectives, and hypotheses, as well as the results, the researcher recommends the following:

• The need to adopt the proposed training program using cross-training exercises in the training process within the field of karate training.

importance of using The physical ability and tests the effectiveness of complex skill performances to assess the level of young female karate practitioners before and during the implementation of training programs.

• The importance of trainers focusing on individual differences and determining the training load that suits the varying abilities of the young practitioners.

• The need to integrate crosstraining activities with complex skill performances in karate.

• Conducting more studies similar to the present research on other sports activities and samples.

• Training coaches who are involved in preparing young karate athletes on the clear scientific foundations of the cross-training program, as it has a significant impact on improving the physical and skill levels of the young practitioners in karate.

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