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The Effect of a Combined Training Program (Aquatic–Trampoline) on Functional Efficiency, Dynamic Balance, and Breaststroke Swimming Performance in Women Aged 45–50 Years

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Abstract

This study aimed to develop a combined aquatic and trampoline training program and to investigate its effect on functional efficiency, particularly heart rate recovery after exertion, dynamic balance and breaststroke performance, among female swimmers aged 45–50 years. The researcher employed a single-group experimental design with pre- and post-tests. The sample include eight female swimmers purposively choose from Top Level swimming pool. The training program lasted eight weeks comprising three training sessions per week for a total of 24 sessions. It included both aquatic and trampoline training following a progressive training load principle. Data were gathered using the functional efficiency test (heart rate recovery after exertion) the revised Bass test for dynamic balance and a 50-meter breaststroke performance test. The findings were statistically analyzed using the mean, standard deviation and paired-samples t-test at a significance level of $p \leq 0.05$. The results presented a significant improvement in all research variables. The functional efficiency index increased from (17.00 ± 1.31) to (25.00 ± 1.31), representing a 47.06% improvement. Dynamic balance increased from (35.50 ± 2.45) to (40.50 ± 2.45), a 14.08% improvement. Conversely the time for the 50m breaststroke decreased from (65.25 ± 3.96) seconds to (61.75 ± 4.11) seconds, a 5.36% improvement. All differences were statistically significant ($p < 0.05$). The researcher concluded that combined training (aquatic-trampoline) is an effective training method for improving functional efficiency, dynamic balance and breaststroke performance levels among women swimmers in this age group.

Keywords: Aquatic training, trampoline, functional efficiency, dynamic balance, breaststroke

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Introduction :

The field of sports training is witnessing continuous enhancement in the use of modern training methods aimed at improving physical, functional and skill-based abilities across different age groups. The use of combined training programs has become a modern trend in sports training science due to the diverse training stimuli they provide, which contribute to more effective physiological and motor adaptations compared to traditional methods. The significance of these programs is particularly evident for middle-aged women as this stage is accompanied by a range of physiological and functional changes that gradually affect the efficiency of vital systems and motor abilities. This in turn impacts physical and skill performance and participation in different sports activities. many researchers demonstrate that the use of combined training programs has become a modern trend in sports training because it offers diverse training stimuli that contribute to improving physical and skill-based abilities and creating more effective functional and motor adaptations compared to traditional methods (Ibrahim & Ali, 2026).

Aquatic training is one of the most appropriate training methods for this age group due to the unique properties of the aquatic environment. These properties decrease pressure on the joints and spine caused by buoyancy and provide natural resistance for movement in all directions. This helps improve muscular strength, endurance and the functional efficiency of the circulatory and respiratory systems, while mitigating the likelihood of injuries or physical strain. Furthermore exercising in water improves cardiovascular and respiratory efficiency by increasing oxygen delivery to working muscles and enhancing the body's capacity to sustain performance for longer periods. This makes aquatic training an effective way to improve functional and motor skills in middle-aged women Studies have indicated that aquatic training contributes to developing physical abilities and improving functional efficiency due to the natural resistance of water and the ability to regulate the intensity of the workout to suit the nature of the movement It important role in raising performance levels and improving functional and muscular adaptations (Raouf Mahmoud & Yasir, 2024).

In other hand trampoline training is a modern training method that depends on performing rebounding movements and repeated jumps requiring a high degree of neuromuscular control to maintain body balance during performance. These exercises contribute to activating sensory receptors, improving vestibular function and developing neuromuscular coordination and kinesthetic awareness They also play a role in developing dynamic balance which is a fundamental requirement for many sports activities (Zayed & Shehata, 2019; Kamil & Sheet, 2024). Furthermore the flexible surface of the trampoline necessitates continuous motor adjustments by the trainee to maintain balance leading to improved motor control and rapid response to numerous changes during performance (Sun et al., 2025).

Breaststroke is a swimming style that requires a high degree of coordination between arm and leg movements and breathing as well as a suitable level of functional efficiency and

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dynamic balance to maintain a streamlined body position in the water and achieve economical performance that lower the energy consumption and improves results Proper breaststroke technique depends heavily on the swimmer's ability to control body position during the transitions between the pull, propulsion and glide phases, making the development of functional abilities and dynamic balance important for improving performance (Ghazwan et al., 2025; Abdulghani & Hussain, 2025).

In spite of various studies examining the effect of aquatic training or trampoline training alone on the development of certain physical and functional variables research investigating the effect of combining these two training methods on women swimmers aged 45–50 remains limited. This motivated the researcher to design a combined aquatic and trampoline training program to investigate its impact on functional efficiency, dynamic balance and breaststroke performance. The importance of this research depends in the potential to utilize the results of this program in developing training programs for middle-aged women enhancing their functional and motor skills and positively impacting their performance in swimming and various physical activities.

The research goals to develop a combined training program that combines aquatic training and trampoline training, and to identify its effect on developing functional efficiency, dynamic balance and breaststroke performance level among women practicing swimming aged (45-50) years.

The researcher assumes that there are statistically important differences between the results of the pre-test and post-test, in favor of the post-test in the variables of functional efficiency, dynamic balance and breaststroke performance level among the research sample as a result of implementing the combined training program.

The research was limited to a group of women practicing swimming aged (45-50) years in the Top Level swimming pool and the research procedures were conducted during the period from 1/10/2025 until 1/12/2025.

Methods and Instruments

Research Methodology

The researcher used the experimental method because it was appropriate for the nature of the research and the achievement of its objectives. It is considered one of the most suitable scientific methods for studying the impact of the independent variable on the dependent variables by controlling the conditions surrounding the experiment and monitoring the changes that occur as a result of implementing the training program. The researcher accepted a single-group design with pre- and post-tests to identify the effect of the combined training program (water-trampoline) on functional efficiency, dynamic balance and breaststroke performance level among the research sample.

Research community and sample:

The research population was purposively chose from women aged 45–50 years who consistently swim at the Top Level swimming pool. This group demonstrate the target demographic for the study of the combined (aquatic-trampoline) training program The research

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sample was also purposively selected from this same population consisting of eight women who regularly swim This sample comprised the experimental group that underwent the proposed training program. The participants were chosen based on their similar age, experience level ability to commit to the training sessions throughout the experiment and their good health which allowed them to participate in the training program and take the research tests.

Devices, tools and methods used

1. Arabic and foreign sources and references
2. Educational swimming pool.
3. Trampoline machine.
4. Electronic timers.
5. Pulse measuring device.
6. Whistle.
7. Measuring tape.
8. Adhesive tape.
9. Data and results recording forms.
10. Electronic calculator.
11. Supporting staff

Tests used in the research

Choosing a method for measuring job performance: (Dewor, 2023)

Test Name: Functional Competency Measurement Test

The purpose of the test is to measure the functional efficiency of the circulatory-respiratory system.

Tools used:

- Stopwatch.
- Pulse measuring device.
- A chair for relaxation.
- Registration form.

Test description: The subject performs physical exertion such as swimming The pulse rate is then measured immediately after the exertion and again during the recovery period after 1 to 3 minutes.

Registration: It was calculated using the following equation:

Functional efficiency = Pulse immediately after exertion - Pulse after one minute.

Dynamic Balance Test: (Halabchi, 2020)

Name of the test: Modified Bass test for dynamic balance.

The purpose of the test: - To measure the ability of the examinees to maintain body balance during movement and transition between the specified marks.

Tools used:

- Adhesive tape to mark the locations of the jumping.
- Stopwatch
- Registration form.

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- A flat, non-slip floor

Method of operation:

1- Markers are drawn on the ground according to particular distances.

2- The test subject relies on their preferred foot behind the starting line.

3- It proceeds by positioning the specified marks in sequence.

4 - You must remain still for 5 seconds after each jump.

5 - A point is calculated for each successful attempt with deductions for errors related to loss of balance or touching the ground.

Registration method:

A score is awarded upon successful maintenance of the specified mark (in this test, 10 circles were drawn, each circle worth 5 marks) The maximum mark is 50 marks.

- The higher the degree the better the level of dynamic balance.

- 50m breaststroke swimming achievement test:

- The intention of the test: - To measure the time it takes to cover a distance of 50 m breaststroke at maximum speed.

- Tools used:-

Stopwatch, whistle, form, registration.

Performance description:

The swimmer persists on the starting board, taking the appropriate ready stance and upon hearing the whistle, the swimmer jumps into the water, attempting to encompass the distance with maximum effort until reaching the final edge of the mentioned distance.

- Laboratory degree: minutes, seconds and fractions thereof.

Exploratory experiment

The researcher carried out the exploratory experiment on Wednesday, 1/10/2025 on a sample of (2) women practicing swimming from outside the research sample with the goal of confirming the validity of the tests and tools used knowing the time need to implement them and identifying the difficulties that may be faced in implementing the main experiment and working to address them as well as organizing the work of the support team and the mechanism for recording the findings.

The researcher was careful to establish specific conditions for the tests in terms of place, time, tools used, method of implementation, and the assisting team to ensure the accuracy of the results.

Pre-tests

The researcher conducted pre-tests for the research sample before commencing the training program These tests took place on Saturday, October 4, 2025, and Monday, October 6, 2025, and included functional competency tests, dynamic balance tests and a 50-meter breaststroke swimming performance test The researcher confirmed that all participants received the same testing conditions in terms of location, time, equipment and method of execution to guarantee accurate and reliable findings that could be compared with the post-test results.

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Training program

The researcher designed a combined aquatic and trampoline training program, tailored to the research objectives and the nature of the study sample to develop functional efficiency, dynamic balance and breaststroke performance among women aged 45–50. The exercises were developed based on pertinent scientific sources, references, and prior studies as well as the researcher's experience in sports training. The program was then reviewed by a group of experts and specialists to confirm its suitability and appropriateness for the research sample.

The training program lasted eight weeks with three training sessions per week on Saturdays, Mondays and Wednesdays, for a total of 24 training sessions. Each session lasted 60 minutes and was separated into different sections (Appendix 1).

The researcher based the determination of training load intensity on scientific recommendations for physical activity and aerobic training in middle-aged adults These recommendations suggest that a moderate intensity (50–75% of maximum heart rate) is safe and effective for developing functional efficiency, cardiorespiratory capacity and motor balance in non-athletes or those who regularly engage in physical activity while decreasing the risk of fatigue and injuries associated with high loads. This intensity is also acceptable for the physiological characteristics of women aged 45–50 allowing for gradual functional adaptations in the circulatory and respiratory systems while maintaining the integrity of vital organs and the participants' ability to continue the training program The researcher adopted the principle of progressively increasing training load based on the principles of sports training which emphasize the necessity of moving from low to moderate and then relatively high intensities to ensure the required physiological and motor adaptations and achieve appropriate training response (American College of Sports Medicine [ACSM], 2024; Gibson et al., 2024).

The training session included three main parts The introductory part included general and specific warm-up exercises, stretching exercises and joint mobilization exercises lasting 10–15 minutes The vital part lasted 35–40 minutes and included a sequence of trampoline exercises such as vertical jumps, jumps with a change of direction, jumps with open and closed legs and balance exercises after landing It also included a series of breaststroke exercises of varying intensity, focusing on improving motor balance, functional efficiency and skill performance. The concluding part lasted 5–10 minutes and included light swimming and cool-down and relaxation exercises to progressively return the body's systems to their normal state.

When implementing the program the researcher considered the principles of continuity, gradual progression, individual differences and training safety in a manner appropriate to the characteristics of women at this age while highlighting the gradual transition from low to high loads to ensure the achievement of the training program’s objectives and the attainment of the best possible functional and motor adaptations.

Post-tests

The researcher carried out the post-tests for the research sample after the completion of the (8) week training program on 1/12/2025 using the same tests tools and procedures that were used in the pre-tests taking into account the constancy of all conditions connected to the

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testing process to ensure the accuracy of the contrast between the results of the pre-test and post-test and to know the extent of the development that took place in the research variables.

Statistical methods

The researcher implemented the Statistical Package for the Social Sciences (SPSS) to process the research data and extract the findings. The arithmetic mean and standard deviation were used to describe the research sample data as well as using the T-test for correlated samples to detect the significance of the differences between the results of the pre-test and post-test in the research variables A significance level of (0.05) was adopted to judge the significance of the results.

Table1. Showing the results of the arithmetic mean, standard deviation, calculated t-value and significance level for the pre-test of the research variables

Statistical Significance	Significance	(T)	Post test		Pre test		Unit of measurement	Variables
			SD	Mean	SD	Mean		
Significant	0.000	13.00	1.31	25.00	1.31	17.00	Beats/min	Functional efficiency
Significant	0.000	14.00	2.45	40.50	2.45	35.50	Degree	Dynamic balance
Significant	0.000	7.07	4.11	61.75	3.96	65.25	Second	Breaststroke time performance 50m

Significant at (0.05).

Discussion:

The research results presented a crucial improvement in functional efficiency among women aged 45–50 who practiced swimming indicating the effectiveness of the proposed program in improving the efficiency of the cardiorespiratory system during physical exertion This is attributed to the nature of the exercises used which combined the aerobic element in the water with dynamic balance on a trampoline All of this led to the improvement and adaptation of the body's functional systems. This related with Wajih Mahjoub's opinion that aquatic training contributes to improving the efficiency of the cardiorespiratory system as swimming needs water resistance which in turn raise the workload of the heart and lungs. These adaptations improve oxygen delivery to the working muscles and decrease fatigue during performance which is indicated in the higher functional efficiency index in the post-test. (Bosetto et al., 2025).

In contrast trampoline training also helped to activate the neuromuscular system and develop heart efficiency through intermittent exertion as repeated jumps require quick responses between the nervous and muscular systems resulting to improved functional endurance and faster recovery between exertions (Aslam et al., 2025).

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The researcher agrees with Gibson et al (2024) that combining aquatic training and trampolining created a variety of intensity and training environment which assisted to bring about physiological adaptations involving the circulatory, respiratory and muscular systems and this in turn improves functional efficiency. Also practicing swimming, particularly breaststroke, at a moderate intensity is considered one of the aerobic systems that raises the efficiency of the heart and lungs especially with this research sample of the age group (45-50 years) as it helped them to develop the economy of effort and lower energy consumption during performance (Chen et al., 2024).

From the table above the findings of the dynamic balance test indicate significant differences between the pre-test and post-test and the post-test is valid. The researcher features this development to the prepared training program that contributed to the development of dynamic balance in the research sample through the development of neuromuscular coordination and complex control. This is consistent with Sun's statement that trampoline training consists of rebounding movements and repeated jumps that need the trainee to continuously maintain the body's center of gravity during performance which leads to raised efficiency of neuromuscular control and improved balance during movement (Sun, et al, 2025).

Training on a relatively flexible and unstable surface such as a trampoline requires continuous adjustments to the movement in order to maintain performance and stability In this way it contributes to the improvement of the vestibular system and motor senses which show their positive development on dynamic balance cause of the adaptation of the nervous and sensory systems to the nature of the exercises used (Shehata, 2019) It must also be observed that the aquatic environment helps to decrease the pressure on the joints while continuing to provide resistance to the movement.

Therefore, water training is considered a safe training especially for middle-aged people as it develops neuromuscular coordination and motor balance (Ries, 2020). As we know breaststroke swimming by its nature requires continuous motor integration between the arms and legs while maintaining horizontal flow of the body in the water. This leads to the development of control over body movement and strengthening of its muscles especially those responsible for balance and stability, particularly the trunk, abdominal and back muscles (Fantozzi, et al., 2022).

The researcher also believes that her work in combining trampoline training and breaststroke swimming has contributed to providing diverse motor stimuli, as trampoline training has contributed to the development of the muscular system and breaststroke swimming has helped with muscle control and the development of motor coordination. This combination and integration between the two trainings has led to the development of the sample's ability to maintain balance during movement and mobility.

From the same table we observe an improvement in the time spent performing breaststroke for the sample, which is of course a result of the development in functional efficiency and dynamic balance. This is due to the effectiveness of the training program that combined trampoline training and aquatic training, which is important in developing the motor

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and basic abilities associated with breaststroke performance. As we have observed trampoline training has clearly contributed to developing dynamic balance and neuromuscular coordination as it consists of continuous jumping movements, changing body positions and the body's ability to control the center of gravity. This in turn was reflected in the performance in the water by improving stability during leg movements. In contrast the aquatic training that was used contributed to the development of physical abilities especially specific strength and strength endurance as the continuous water resistance during movement activated the working muscles in a manner appropriate to the ages of the sample. Aquatic training reduces pressure on the joints, which helped them to continue training and repeating, and improve functional and motor efficiency without fatigue and exhaustion.

This is consistent with Verrelli's assertion that breaststroke requires high coordination between the arms and legs with appropriate timing between pull and glide (Verrelli et al., 2023). Therefore, the program contributed to the enhancement of neuromuscular coordination which in turn was reflected positively on the performance time of the breaststroke for the sample. Talha stated that "the variety in training stimulation contributes to increasing the efficiency of motor performance" (Lafe & Newell, 2022).

Conclusions:

- The integrated training program (water-trampoline) implemented for (8) weeks contributed to improving the functional efficiency interduced by the heart rate recovery index after exertion in women practicing swimming aged (45-50) years from the research sample.
- The combined training program significantly improved the dynamic balance of the research sample as evidenced by the higher scores on the modified Bass test for dynamic balance in the post-test compared to the pre-test.
- The research sample reached a significant improvement in the time spent performing the breaststroke swim for a distance of (50m) after applying the training program compared to the findings of the pre-test.
- The simultaneous improvement in functional efficiency and dynamic balance indicates the potential for merged training (aquatic-trampoline) to contribute to supporting the skill performance requirements of breaststroke swimming among women practicing swimmers within the studied age group.
- The results of this study showed the effectiveness of the combined training program in developing the functional motor and skill variables under study in the research sample contain of women practicing swimming aged (45-50) years

Recommendations:

- Adopting the combined training program (water - trampoline) in training women practicing swimming at middle ages according to its positive impact on developing functional efficiency, dynamic balance and performance level.
- giving attention to the use of water exercises as a safe and effective training method for middle-aged women as they provide suitable resistance while decrease the pressure on the joints.

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- Utilizing trampoline training to improve dynamic balance and neuromuscular collaboration in various sports activities and events.
- performing similar studies on different age groups and both genders to verify the effectiveness of the training program in diverse conditions.
- Conducting future studies that address the effect of aquatic and trampoline training on other physical, functional and physiological variables not addressed in the current research.

Model Training Unit (Aquatic – Trampoline) Participants: Female Recreational Swimmers Aged 45–50 Years

Unit duration 60 : Minutes

Training Intensity 70-60 : Minutes

Warm up part 15-10 : Minutes

Exercise	Intensity	Time
Light walking	%50	Minutes 5
Muscle Stretching Exercises for the Legs, Arms, and Trunk	%50-60	Minutes 5
Joint Exercises (Shoulder – Knee – Ankle)	%50	Minutes 5

Minutes 35 -40 : Main part

Exercise	Intensity	repetition	Rest between repetition	Sets	Rest
Second Jump on the Trampoline	%60	10	s10	3	s6
Jumping with Legs Apart and Together	%60	10	s10	3	s60
mping with Direction Changes on the Trampoline	%60	10	s10	3	s60
Jumping with Balance Stabilization After Landing	%60	10	s10	3	s60

Exercise	Intensity	Sets	Rest between repetition	Rest between Sets
Slow breaststroke swimming	%50	4(2×25)	s60	s90
Balanced breaststroke swimming	%60	4(2×25)	s60	s90

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Complete breaststroke swimming	%65	4(2×50)	s90	s120

Final part 10-5) Minutes

Exercise	Intensity	Time
Cool down in water (very light swimming)	%50	Minutes 5
General muscle exercises	lower	Minutes 3
Relaxation exercises	lower	Minutes 3

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