BALLISTIC STRETCHING EXERCISES AND THEIR EFFECT ON EXPLOSIVE STRENGTH, FLEXIBILITY, STROKE LENGTH, AND STROKE FREQUENCY OF THE WORKING LIMBS IN YOUTH SWIMMERS OF WASIT GOVERNORATE CLUBS

Mutaman Jabar Mohamed Hussein
Wasit University,
IRAQ

Hasan Hadi Abed Hasuwni Alhamrawi
Wasit University,
IRAQ

Hayder Mahdi Dakhil Al hlew
Wasit University
IRAQ

Corresponding Author: mutamanj.mohamed639@uowasit.edu.iq

Recieved: March 23, 2026 **Accepted:** May 19, 2026

ABSTRACT

Background. The researcher focused on employing ballistic stretching exercises to develop certain forms of muscular strength and flexibility, which are considered essential requirements for swimmers. These exercises are distinguished by their ability to enhance flexibility through rapid, explosive movements performed within a specific range of motion, with the potential for progressive improvement through continued training, depending on the anatomical characteristics of the joint and muscle. **Objectives.** The study aimed to design ballistic stretching exercises and identify their effects on selected forms of strength and flexibility. **Method.** The researcher adopted an experimental method using a single-group design with pre- and post-tests. The research sample was intentionally selected and consisted of youth swimmers from Al-Kut Club in Wasit Governorate, aged (16–17) years, with a total of (10) participants. Statistical analysis was conducted using the Statistical Package for the Social Sciences (SPSS) to obtain the study results. **Results.** Significant at the level (0.05) when the error level ≤ or = (0.05), and the tabulated t-value = (2.262). The findings indicated that ballistic stretching exercises led to noticeable improvements in explosive strength of both the arms and legs, speed-strength, as well as flexibility. **Conclusion.** The development in swimming performance is attributed to the scientifically structured curriculum, which utilized appropriate intensity, volume, and density. The use of specialized equipment, such as resistance bands and weights during stretching, addressed performance deficits and increased training unit efficiency.

Keywords; ballistic stretching, explosive strength, flexibility, youth swimmers.

A. INTRODUCTION

Modern training methods have significantly contributed to supporting practitioners in the field of physical education by enabling a shift beyond traditional training approaches toward scientifically grounded methodologies (Ali et al., 2026 ; Balore et al., 2026; Abdulloh, 2026).. These contemporary methods facilitate a clearer understanding of the effects of sports training on the development of physical attributes. The adoption of innovative training techniques is essential for improving athletic performance in general, and swimming performance in particular, as it plays a crucial role in enhancing physical capacities and advancing athletes toward higher levels of achievement (Hamzah, 2026; Fufu et al., 2026).

Swimming is distinguished from other sports by its aquatic environment, where movement is achieved through coordinated actions of the arms, legs, and other body parts. Consequently, this sport requires the application of structured training programs designed by coaches to improve swimmers' capabilities and enable them to achieve performance levels that were previously difficult to attain.

From the perspective of researchers and specialists in swimming, swimming speed is primarily determined by two variables: stroke length and stroke frequency. Across all swimming styles, achieving an optimal balance between these two variables is essential. Their development is influenced by training, and their application varies according to the type of stroke (freestyle, butterfly, breaststroke, and backstroke) and race distance. Therefore, muscular strength and flexibility play a fundamental role in optimizing these performance determinants. Accordingly, the researcher focused on employing a relatively novel training approach—ballistic stretching—to develop certain forms of explosive strength and flexibility, which are considered key requirements for swimmers.

The research problem emerged from the researcher's experience as a former swimmer, as well as from reviewing numerous training programs used by local clubs. It was observed that swimmers, especially at the local level, showed a marked decrease in power production, resulting in suboptimal performance when compared to international standards. Additionally, insufficient attention to various muscle stretching techniques negatively affects the optimal expression of strength. Muscular work is defined as the product of force and the distance over which the muscle acts. Therefore, enhancing muscle performance requires optimizing both components. The researcher proposed the use of stretching methods that could increase muscular work output, particularly by improving the muscle's ability to generate force over a greater range of motion (Hassan & Al-Thar Abd, 2026; Mduwile et al., 2026).

Given that human muscles possess elastic properties, muscle stretching increases the effective working length of the muscle beyond its resting state. This elasticity contributes to greater muscular work output when force is applied across an extended range of motion. Consequently, improvements can be achieved in both explosive strength and speed-strength. Based on these considerations, the researcher deemed it important to investigate this topic scientifically to highlight the practical significance of ballistic stretching as an effective training method. To design ballistic stretching exercises for youth swimmers.

To identify the effects of ballistic stretching on certain forms of explosive strength and flexibility in youth swimmers. This is a formal academic translation of the research article excerpt, adhering to the terminology used in sports science and physical education.

B. METHOD

Participant.

The research sample was selected using a purposive sampling method, consisting of (10) youth swimmers (aged 16–17 years) from Al-Kut clubs in Wasit Governorate. This sample represents 66.66% of the original research population of (15) swimmers distributed across three clubs. The researcher ensured the homogeneity of the sample to verify the lack of significant initial variances.

Table 1. Homogeneity of the Research Sample Participants

No.	Variable	Unit of Measure	Mean ($\bar{x}$)	Standard Deviation (SD)	Skewness Coefficient
1	Weight	kg	71.00	4.42	0.222
2	Height	m, cm	176.33	5.01	-0.969
3	Training Age	Month	44	2.50	-0.968

The table above indicates that the skewness coefficient values ranged between (-1 and +1), confirming the homogeneity of the research sample across the specified variables.

Research Design.

The researcher employed the experimental method, as it is defined as "the attempt to control the situation intended for study" (Allawi & Ratib, 1999, p. 217).

Table 2. Research Tools, Equipment, and Instruments

Equipment	Research Tools	Instruments
Arabic and foreign sources.	Whistles (2).	Electronic stopwatches (2), CASIO (Japanese).
The Internet.	Resistance (Elastic) bands	Medical scale for weight, Sartorius (German).
Measurements and tests.	Gym mats (4).	Sony Video Camera (24 fps).
	Medicine balls (6).	Dell Laptop (South Korean).
	Measuring tape.	

Table 3. Description of Physical Ability Tests

1	First: Modified Vertical Jump Test from Standing (Sargent Jump) (Lafta, 2017, p. 85).
	Objective: To measure the instantaneous power (explosive strength) of the legs. Recording: Results are calculated using the following mechanical law: $f = \frac{m \cdot d}{(t)2}$
2	Second: Explosive Strength Test for the Throwing Arm (Lafta, 2017, p. 80).
	Test Name: Medicine ball throw (1 kg) from a standing position using one arm from above shoulder level (Modified). Objective: To measure the explosive strength of the throwing arm. Recording: Calculated via the mechanical law: $f = \frac{m \cdot d}{(t)2}$
3	Third: Instantaneous Trunk Power (Hassan & Radwan, 2001, p. 41).
	Objective: To measure the instantaneous power of the trunk. Procedure: The participant lies prone on the ground with hands interlaced behind the back. Upon the signal, the participant raises and lowers the trunk at maximum speed for 10 seconds.

Table 4. Flexibility Test

1	Standing Trunk Extension (Backward Flexion)
	Objective: To measure spinal flexibility. Procedure: Standing in front of a wall with the pelvis stabilized, the participant extends the trunk backward to the maximum possible range. The distance from the wall to the chin is measured in centimeters.
2	Standing Trunk Flexion (Forward): (Salloum, 2004, p. 130).
	Objective: To measure hip joint flexibility. Equipment: A wooden scale (ruler) approximately 20 cm long and a stable bench.
3	Arm Range of Motion (ROM): (Abdul-Karim, 2006).
	Objective: To measure the angular distance traveled by the arm from a lateral position, raised upward and backward to the furthest extent. Equipment: Goniometer.
4	35m Swimming Test
	Objective: To record the time for a 35m swim to calculate the swimmer's stroke frequency and stroke length (Al-Qat, 2005, p. 87). Equipment: Al-Hilla Olympic Pool (50m), electronic stopwatches, whistles, and cameras.

Pre-tests

Pre-tests were conducted at the College of Physical Education and Sports Science for the experimental group. After providing instructions, testing commenced on Saturday, [Day/Month], 2026, at 3:00 PM.

Exercises Used (Main Experiment)

The main experiment involved applying ballistic stretching exercises designed by the researcher (see Appendix). The goal was to enhance specific physical traits (instantaneous power, flexibility, stroke frequency, and stroke length).

Post-tests

Following the implementation of the exercise program, post-tests were conducted on Saturday, [Day/Month], 2026. The researcher ensured consistency in venue, time, conditions, and procedures relative to the pre-tests.

Data Analysis.

The researcher used the SPSS (Statistical Package for the Social Sciences) to analyze results, employing: Mean, Standard Deviation, Skewness Coefficient and Paired Samples T-test.

C. RESULTS AND DISCUSSIONS

Results

Table 5. Arithmetic Means and Standard Deviations of Pre- and Post-Test Results for the Study Variables in the Experimental Group

Variables	Unit of Measurement	Pre-Test Mean	± SD	Post-Test Mean	± SD	Mean Difference	SD of Difference	Calculated t-value	Sig.	Significance
Explosive Strength (Legs)	Newton	1297	109.7	1522.4	216.8	325.3	135.3	7.697	0.001	Significant

Explosive Strength (Arms)	Newton	191.4	5.49	274.3	37.49	82.8	32.99	6.125	0.002	Significant
Trunk Explosive Strength	Repetition	1473	0.752	1864	0.516	391	130.048	8.174	0.000	Significant
Spine Flexibility	Cm	79.16	2.136	87.50	1.870	8.33	2.658	7.679	0.001	Significant
Hip Flexibility	Cm	19.71	1.635	26.916	1.376	7.20	2.298	7.672	0.001	Significant
Arm Range of Motion	Degree	188.9	2.078	204.43	6.997	15.45	6.923	5.466	0.003	Significant
Stroke Length Rate (35 m)	M	1.30	0.05	1.38	0.05	0.08	0.07	5.099	0.005	Significant
Stroke Frequency (35 m)	Count	26	3.76	29.66	1.67	3.66	1.09	5.235	0.004	Significant

Note: Significant at the level (0.05) when the error level ≤ or = (0.05), and the tabulated t-value = (2.262).

Discussion

Table (5) demonstrates that the results achieved were statistically significant, indicating a significant impact of the applied exercises on the research sample. The increased Range of Motion (ROM) of the joints and active muscles led to a notable increase in strength. Trainers should prioritize stretching exercises within the main part of the training session alongside strength and speed drills.

This aligns with Al-Fadhli (2010), who states that stretching exercises increase muscular power because the muscles operating across a joint will act over a greater distance, thereby increasing the mechanical work produced)Work = Strength × Distance). Furthermore, Othman (2018) confirms that exercises enhancing elasticity in muscles and connective tissues increase the storage of elastic energy during the eccentric phase (lengthening), which is then released during the concentric phase (shortening) to produce explosive power.

The significant differences between pre- and post-tests are attributed to the 8-week ballistic stretching program, which was sufficient to induce physiological adaptations. Hasan, B.B et al., 2024), Al-Lami (2010) notes that programs exceeding 6 weeks can result in permanent improvements in ROM. The explosive nature of ballistic stretching effectively enhances both flexibility and elasticity. As Sulayman emphasizes, muscles with optimal elasticity produce more power than those with limited range.

The development in swimming performance is attributed to the scientifically structured curriculum, which utilized appropriate intensity, volume, and density. The use of specialized equipment, such as resistance bands and weights during stretching, addressed performance deficits and increased training unit efficiency. According to Al-Qat (2005), specific stretching exercises improve arm stroke rates and lengths if they maintain levels close to competitive standards, enhancing performance without compromising swimming mechanics.

D. CONCLUSION AND RECOMMENDATIONS

Ballistic stretching significantly improved the instantaneous power of both arms and legs, as well as rapid strength. The ballistic method is effective in increasing joint range of motion and muscular elasticity. Ballistic stretching led to a clear improvement in both stroke frequency and stroke length. Recommendations: Incorporate programmed ballistic stretching exercises tailored to the specific capabilities of the athletes. Adopt the findings of the current study in swimming training programs. Conduct similar studies on other sports. Develop new ballistic stretching protocols while emphasizing safety factors, as these exercises carry injury risks and require high physical readiness.

E. ACKNOWLEDGMENT

No special thanks

F. AUTHOR CONTRIBUTION STATEMENT

Mutaman Jabar Mohamed Hussein, hasan hadi abed hasuwni alhamrawi, & Hayder Mahdi Dakhil Al hlew is responsible for the manuscript in this study.

G. REFERENCE

Abdulloh, F. M. T., Rahayu, A., Kushartanti, B. M. W., Ivanov, D., & Jurek, J. M. (2026). Effectiveness of circulo massage on fatigue recovery of boarding school students. *Tanjungpura Journal of Coaching Research.* *4*(1). 20-31. https://doi.org/10.26418/tajor.v4i1.92920

Abdul-Karim, S. (2010). *Applications of Biomechanics in Sports Training and Motor Performance* (2nd ed.). Baghdad: National Library, p. 164.

Abdul-Karim, S. (2006). *Documented Lectures*. Iraqi Sports Academy Website: iraqacad.org, Lecture 5.

Ali, A. M., Mohammed, D. A., & Hasan, M. A. (2026). Aggressive behavior and its relationship to skill performance efficiency of Kirkuk youth football players. *Tanjungpura Journal of Coaching Research. 4*(1). 20-31. https://doi.org/10.26418/tajor.v4i1.94234

Al-Ali, H., & Fakher, A. (2006). *Rules of Sports Training (Training Cycles, Altitude Training, Recovery)*. Baghdad: Al-Karrar Library, p. 10.

Al-Lami, A. H. (2010). *Sports Training* (1st ed.). Najaf Al-Ashraf: Dar Al-Diya for Printing and Design, p. 208.

Al-Hakim, A. S. (2004). *Tests, Measurement, and Statistics in the Sports Field* (1st ed.). Al-Qadisiyah.

Allawi, M. H., & Ratib, O. K. (1999). *Scientific Research in Physical Education and Sports* Psychology. Cairo: Dar Al-Fikr Al-Arabi.

Allawi, M. H., & Radwan, M. N. (2001). *Motor Performance Tests*. Cairo: Dar Al-Fikr Al-Arabi.

Al-Mandalawi, Q. (1989). *Tests and Measurement in Physical Education*. Mosul: Higher Education Press, p. 107.

Al-Qat, M. A. (2005). *Sports Training Strategy in Swimming* (Vol. 1). Cairo: Arab Center for Publishing, p. 187.

Balore, J. J. N., Fueyo, J., Rubio, A., & Hernández, A. M. (2026). Analysis of coaches' perception of the impact of their stress on the coach-athlete relationship. *Tanjungpura Journal of Coaching Research. 4*(1). 1-19. https://doi.org/10.26418/tajor.v4i1.95617

Fufu, R. D. A., Yuliana, Y., Tajuddin, A. I., Wijaya, I. N. W. E., Neolaka, E. S. (2026). Exploring traditional games in a literature review: How they affect the physical fitness of junior high school students. *Tanjungpura Journal of Coaching Research, 4*(1), 80-91. https://doi.org/10.26418/tajor.v4i1.104416

Hamzah, M. A. (2026). The effectiveness of social recreational games on the psychological skills of wheelchair tennis players. *Tanjungpura Journal of Coaching Research, 4*(1), 62-70. https://doi.org/10.26418/tajor.v4i1.103345

Hasan, B.B., Matty, L.S., & Rahi, M.L. (2024). The effect of six weeks of therapeutic exercises and kinesio tape (KT) in reducing pain and increasing flexibility and muscle strength for people with low back pain . *Int J Disabil Sports Health Sci*;7(Special Issue 2):241-248.https://doi.org/10.33438/ijdshs.1429603

Hassan, A. A., & Al-Thar Abd, J. A. A. (2026). Impact of lateral thinking strategy on certain motor skills and handstand technique in artistic gymnastics for students. *Tanjungpura Journal of Coaching Research, 4*(1), 41-49. https://doi.org/10.26418/tajor.v4i1.103535

Hassanin, M. S. (2001). *Measurement and Evaluation in Physical and Sports Education* (1st ed., Vol. 1). Cairo: Dar Al-Fikr Al-Arabi, pp. 268-269.

Mduwile, P. L., Lufunga, J., & Goswami, D. (2026). Factors influencing student engagement in physical education: Evidence from urban and rural secondary schools in Tanzania. Tanjungpura Journal of Coaching Research, 4(1), 50-61. https://doi.org/10.26418/tajor.v4i1.96833

Othman, M. (2018). *Training and Sports Medicine* (1st ed.). Cairo: Book Publishing Center, p. 483.

Rahi, M. L. (2017). *Construction and Standardization of Specific Physical Tests According to Some Physical and Biomechanical Indicators for the Classification and Selection of Athletics Throwing Athletes Aged 13-15 Years* (Doctoral Dissertation). University of Baghdad, College of Physical Education, p. 85.

Sulayman, S. (n.d.). *Exercises and Illustrated Drills*. Egypt: Islamia for Printing and Computer, p. 30.