

Court vs. Aquatic Upper and Lower Limb Strength Training for Female Basketball Shooting and Passing

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Abstract: This study aimed to identify which strength-training method is more effective for developing layup scoring abilities among junior national team basketball players: training on basketball courts (hard or rubber floors) or training in an aquatic environment. An experimental method was employed with junior national team players during the 2024 sports season. Participants were trained using strength exercises in the two environments, and layup scoring abilities were compared between groups. The findings showed that strength training on basketball courts and in aquatic environments both positively affected the development of abilities related to layup scoring. However, significant differences emerged between the court-trained and aquatic-trained groups in favor of the aquatic environment group, indicating that aquatic strength training was more effective. This study uniquely compares aquatic-medium strength training with conventional court-based training for layup scoring in junior basketball, addressing an underexplored training modality in Iraqi basketball practice. Coaches should consider incorporating strength training in the aquatic environment because of its positive impact on developing layup shooting abilities, while court-based training remains beneficial. This research contributes empirical evidence to basketball training design, supporting the integration of aquatic strength training as an effective method for enhancing performance-specific abilities such as layup scoring in junior players.

Keywords: Aquatic Environments; Basketball Courts; Limb Muscle Strength Training; Shooting and Passing Abilities

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A. Introduction

The scientific development in the field of sports has established new horizons for keeping pace with the great development in the field of sporting events and various games. To achieve good results in team sports activities in general and basketball in particular in sports training requires following scientific methods with high precision and objectivity in a planned manner, in addition to applying new theories and trends, to synchronize modern trends to achieve excellent results and reach a high level.

Lay up shooting is one of the basketball activities in which performance is affected by the development of performance-specific abilities, including (speed-specific strength, explosive strength, and performance-specific strength), which constitute the type of strength required to achieve the technical stages. Most of the previous methods in strength training for female players for peaceful scoring are on basketball courts that may be hard or rubber floors. This method remained for many periods in Iraq, where we use weight training that works to develop strength. If the size of the muscle increases as a result of training, this is called hypertrophy. The hypertrophy that occurs in the muscle is greater with the use of maximum strength training (Peter J. L. Towson, 1996). Talha Hussam also applies many strength training exercises on basketball courts that may be hard or rubber floors, using free weights, pneumatic resistance devices, and various resistance devices using types of moving and fixed muscle contractions (Muhammad Mahmoud Abdel Dayem, Muhammad Subhi Hassanein, 1999).

Now, at the present time, a new trend has emerged in Iraq, which is the use of the aquatic environment in muscle strength training, as this method has positive effects in different directions. This is what Abu Al-Ala pointed out: "Training in the aquatic environment is an effective and influential means of increasing the number and types of training available to the player" (Abu Al-Ala Abdel Fattah, 2003). In addition to the possibility of performing the exercises on a daily and consecutive basis, as these exercises are characterized by high intensity and also the possibility of increasing the time specified for the training unit, it is also possible to benefit from the effects of training inside the water to reduce the time needed by the trainer to learn the skillful and correct performance by raising the special motor abilities (the strength characterized by speed, explosive strength, and the strength specific to performance) associated with performance.

Training in an aquatic environment is distinguished by the reduction of effective body weight due to the higher density of water compared to air. As the arms and legs move through the water, they experience considerable resistance. This resistance can be effectively utilized to enhance muscular strength and improve joint range of motion. Furthermore, as movement velocity increases, the level of resistance correspondingly rises. Consequently, this form of training is inherently demanding and contributes to greater strength development (Katsura, Y., Yoshikawa, T., Ueda, SY. et al., 2010).

Accordingly, water represents an optimal natural setting, as it provides a medium that promotes a sense of relaxation. Moreover, the increase in water resistance contributes to enhancing the athlete's performance from both skill-related and functional perspectives. Its significance is particularly evident in addressing imbalances among different muscle groups, as well as in improving force transmission and the biomechanical function of the ankle joint (Imad Abdel Fattah, 2001).

The importance of the research lies in reviewing many studies and research, it has been proven that the development of special abilities on basketball courts, which may be hard or rubber floors, leads to good results. The same applies to her training in the aquatic environment, which prompted the researcher to conduct an experimental study to compare the two methods, to find out which method is better for developing the capabilities of layup shooting.

By reviewing the researchers' references, sources and studies written in the field of training capabilities for performance on basketball courts, which may be hard or rubber floors, as an old trend, and training in the aquatic environment as a modern trend for training in Iraq. I tried to formulate the research problem by answering the following question of the research problem: What is the most effective method for strength training in the aquatic environment and basketball courts that may be hard or rubber floors to develop the abilities of layup shooting? This paper is to develop a systematic approach to strength training on basketball courts, which may be hard or rubber, and in water, to develop some of the skills required for layup shooting and Identify which of the two methods is more effective in developing layup shooting skills. The research hypothesis: Strength training on basketball courts, which may be hard or rubberized, and in aquatic environments, has a positive effect on developing certain skills related to layup shooting.

B. Methods

The experimental approach used because it is suitable for the nature of the research. The ten players of the national football team were deliberately selected because they represent the high level of the country as a research community. The researchers divided the research sample randomly into two groups. The first group (the first experimental group) consisted of five players who trained using the resistance training method on basketball courts that could be hard or rubber floors, while the second group consisted of five players who trained using the resistance training method in the aquatic environment. The researcher performed equivalence for the research sample in (weight, Length, training age and chronological age) shown in Table 1.

Devices and tools used in the research:

1. References
2. Tests and measurements
3. A device for measuring height and weight
4. A swimming pool measuring 25 x 2
5. A stopwatch

2-4 Tests Used:

After reviewing scientific sources and references to determine the most important tests for data collection, the following tests were developed, as shown in Table (2). It should be noted that all of these tests are used in studies (Master's and Doctoral) and are standardized in the Iraqi environment.

Table 1. The Purpose of The Test

No	Test	Purpose
1	Layup shooting Test	Measuring the explosive strength of the working muscles involved in ladder scoring
2	Passing test and receiving the ball towards the overlapping circles from a distance of 3m (1).	Measuring passing speed and accuracy
3	Push-Pass Accuracy Test (2)	Measuring the accuracy of passing by pushing with both hands towards the goal

Exploratory experiment:

On 5/1/2024 AD on a sample of (8) female players from the Rusafa Education team. To determine the repetitions and groups. As well as knowing the extent of how to conduct strength exercises for the research sample individuals and the appropriate place to apply the training curriculum, in addition to knowing the possible errors and working to avoid them during training, whether those errors were made by the work team or by the research sample individuals, in addition to knowing how to conduct the tests used.

Procedures of Research

Pretests:

The pretests were conducted on the research sample on May 7, 2024, at 9:00 AM. All temporal and spatial conditions were fixed to ensure consistency with the posttests and avoid errors.

Training curriculum:

The proposed training curriculum was prepared after reviewing a group of sources and references related to the research topic. The curriculum's components were applied on

5/3/2006 for a period of ten weeks. The curriculum included (30) training units, at a rate of (3) units per week (Saturday – Monday – Wednesday). The repetitive training method was used, and the principle of increasing resistance was adopted for strength training with body weight on basketball courts, which may be hard or rubber floors, and in the water environment, and the principle of gradual increase in the water level, as all the training was specific to the motor performance for the effectiveness of layup shooting.

The water level was set at a height of 30 cm, based on the results of a pilot study. This height is a key resistance factor when the research participants perform the exercises. This level was adopted based on several previous studies and experiments that demonstrated improved accuracy in motor performance, as well as a clear effect of training through increased training load (in terms of intensity and exercise distribution, while controlling the water level as a resistance mechanism).

The researcher used a graduated ruler to precisely measure the required water level before commencing the training sessions. Each training session lasted 50 minutes, including warm-up and rest periods. The time spent performing the exercises in the water was 30 minutes, as was the time spent training on the basketball courts, which had either hard or rubber surfaces for the second group. The training program concluded on August 20, 2024.

Post-tests:

on June 21, 2024, at 9:00 AM the Post-tests were conducted, at the Al-Hurriya Youth Club stadium. The researcher took into account the time and place conditions in her pre-test.

C. Results and Discussion

Presentation and analysis of the results of the pre- and post-tests for the first experimental group (on basketball courts that may be hard or rubber floors) and their discussion:

Table 2. The Arithmetic Mean of the Mean Differences and Its Standard Deviation, and The Calculated and Tabulated (T) Value, Between The Pre- And Post-Tests, for the Individuals in the First Experimental Group (On Basketball Courts That May Have a Hard or Rubber Floor)

Tests	M.D.	Std. Deviation of M.D.	C. t-value	T. t-value	Sig type
Layup shooting Test	0.22	0.11	5		Sig
Passing test and receiving the ball towards the overlapping circles from a distance of 3m.	0.21	0.7	6.1	4.6	Sig
Push-Pass Accuracy Test	0.22	0.1	4.7		Sig

In order to test the hypotheses related to the significance of the differences between the pre- and post-tests for the individuals in the group who train on basketball courts that may be hard or rubber floors, we used the t-test for related samples. It is clear from Table 3 that the calculated t-value for the above tests reached (5), (6.1), (4.7) respectively, which is the largest in relation to the tabular t-value, which is (4.6) a probability of error of (0.01). Since the calculated value was greater than the table value, it means that there are significant differences, in favor of the post-tests, meaning that the experimental group trained using resistance on basketball courts, which may be hard or rubber floors. She achieved development in some of the tests of abilities related to peaceful aiming, and the researcher attributes this to the use of body weight resistance exercises that are appropriate to the type of activity, as they have a positive effect to developing those abilities, as they contain some alternate jumps and hops, etc.

Bodyweight training is one of the training methods that affect the development of the muscle groups involved in performance and works to develop speed and motor speed. Working with body weight aims to develop the qualities of strength and speed, as well as using body weight with the addition of weights to increase resistance. It is considered one of the means of developing muscular strength, especially muscular strength that has a special characteristic in performance, such as starting strength or initial strength in muscle groups of the body, according to the basic goal of performance (Abu Al-Ala Abdel Fattah, 2003).

Presentation and analysis of the results between the pre- and post-tests for the second experimental group (in the aquatic environment) and discussion of them:

Table 3. The Mean of the Average Differences and Its Standard Deviation and the Calculated and Tabulated (T) Value Between the Pre- And Post-Tests For the Individuals of the Second Experimental Group (Training in the Aquatic Environment)

Tests	M. D.	Std. Deviation of M.D.	C. t-value	T. t-value	Sig type
Layup shooting Test	0.53	0.13	8.4		Sig
Passing test and receiving the ball towards the overlapping circles from a distance of 3m.	0.44	0.08	11	4.6	Sig
Push-Pass Accuracy Test	0.49	0.13	8.1		Sig

In order to test the hypotheses related to the significance of the differences between the pre- and post-tests for the individuals of the second group who were trained in the aquatic environment, the (t) test for correlated samples was used. It became clear from Table (4) that the (t) values calculated for the above tests reached (8.4), (11), (8.1) respectively, which are larger than the tabular t values, which amount to (4.6) a probability of error of 0.01. The calculated value was greater than the table value, which means that there were significant differences in favor of the post-tests, meaning that the second experimental group that trained using resistance in the aqueous medium it has

also achieved development in some tests of abilities related to peaceful aiming, and the researcher attributes this to the use of resistance exercises in the aquatic environment, which are appropriate for the type of activity, due to their positive impact in developing these abilities. Adding resistance to influence the development of muscular efficiency of the muscle groups working on the joints has a noticeable effect in raising the level of muscular capacity, which will positively affect the level of special abilities of these parts when applying different movements.

Table 5. The Arithmetic Means, Standard Deviations, and The Calculated and Tabulated (T) Value Between the First and Second Experimental Groups (Training on Basketball Courts That May Be Hard Or Rubber Floors and in the Aquatic Environment) in the Post-Tests

Tests	Basketball court training kit that can be hard or rubber floor		Aquatic Training Group		C. t-value	T. t-value	Sig type
	M.D.	Std. Deviation	M.D.	Std. Deviation			
Layup shooting Test	6.7	0.08	6.9	0.04	5.8		Sig
Passing test and receiving the ball towards the overlapping circles from a distance of 3m.	7.8	0.07	8.1	0.1	4.3	3.36	Sig
Push-Pass Accuracy Test	6	0.12	6.2	0.04	3.94		Sig

Discussion

In order to test the hypothesis regarding the importance of differences between the first and second experimental groups (the group that trains on basketball courts that may be hard or rubber floors and the group that trains in the water environment) in the post-tests, the (t) test for independent samples was used. It became clear from Table (5) that the (t) values calculated for the above tests reached (5.8), (4.3), (3.94). Respectively, it is greater than the table (t) values, which amount to (3.36) a probability of error (0.01). Differences also emerged between the post-tests of the two groups, demonstrating that the second experimental group, which trained using resistance in water, showed greater improvement in some skills tests related to free throw compared to the first group (Yosra Hasoon Motashar, & Saif Ali Mohammed, 2023). Researcher's attribute this to the fact that the frictional resistance resulting from varied exercises contributes to gradual muscle strengthening when the training program is applied in water. This was confirmed by Emad Abdel Fattah, who indicated a positive effect of using different levels of resistance, according to the nature of the performance within the aquatic environment, on performance strength.

The present findings, which demonstrate the superiority of an in-water resistance training programme over a land-based hard/rubber court programme for improving free-throw-related skills, must be situated within the broader international literature. This continuation of the discussion will critically compare the results with international research, acknowledge the study's limitations, and draw out theoretical implications.

The central finding that aquatic resistance training produced greater improvements in free-throw skill tests than land-based training aligns with a growing body of international evidence that positions the aquatic environment as a potent and potentially superior medium for specific aspects of athletic development in basketball players. A recent study by Uma, V. (2026) directly compared traditional resistance training with aqua resistance training in male basketball players over twelve weeks. Their conclusion that the "Aqua resistance group demonstrated superior performance gains compared to the other groups, suggesting it is a highly effective training modality for basketball athletes" provides robust international corroboration for the present study's directional hypothesis. While their dependent variables were speed and agility rather than free-throw accuracy, the overarching pattern that the unique properties of water amplify training adaptations is consistent.

Further afield, research comparing land-based and aquatic plyometric training in young male basketball players has reported that aquatic-based programmes can produce comparable, and in some parameters superior, outcomes. Sarikurt & Ozen (2026) examined lower-limb power and flexibility across aquatic and land plyometric groups, contributing to a debate on the relative efficacy of these modalities. More specifically, Buga and Gencer (2022) found that in agility measurements, "the best improvement was in favor of the group working in water" among basketball players aged 12–15. The consistency of aquatic superiority across different physical qualities speed, agility, and now, as in the present study, sport-specific skill execution strengthens the external validity of the current findings and suggests that the aquatic advantage is not confined to a single performance domain.

The explanatory mechanism proposed in the present study that frictional resistance from varied exercises in water contributes to gradual muscle strengthening is supported by international work on the neuromuscular and mechanical demands of aquatic training. The water environment imposes a unique form of resistance that is velocity-dependent and multidirectional, requiring athletes to recruit motor units in a manner distinct from the predominantly vertical and impact-based loading of land-based court training. This is corroborated by the finding that aquatic plyometric training can significantly improve dynamic stability of the lower limbs, with effects sustained for up to four weeks after training cessation. For the free throw, which demands a stable base of support and finely graded force production through the kinetic chain, such stability improvements are functionally relevant. The present study's observation that the aquatic group excelled in free-throw tests may therefore be mediated not merely by

gross strength gains but by enhanced neuromuscular control and joint stability qualities that transfer to the closed skill of shooting.

However, the international literature is not unanimous in declaring aquatic training categorically superior. Some comparative studies have concluded that aquatic and land-based plyometric training have “similar effects on performance”. A systematic consideration of this discrepancy is instructive. Where equivalence has been reported, the training protocols have often been matched for volume and intensity in ways that may mask the unique loading profile of water, or the outcome measures have been gross motor qualities (e.g., vertical jump height) rather than fine sport-specific skills. The present study’s focus on free-throw performance a task requiring precise inter-limb coordination and proprioceptive calibration may be precisely the type of outcome where the sensory and mechanical distinctiveness of the aquatic environment confers an advantage that gross power tests fail to capture. Furthermore, the finding that land-based plyometric training was associated with greater muscle damage than aquatic training suggests that the aquatic medium may permit a higher quality of skill rehearsal with less interference from exercise-induced muscle soreness, a factor of clear relevance to the present study’s skill-focused outcomes.

Several limitations must be acknowledged when interpreting the present findings. First, the study’s sample and design constrain generalisability. The use of a post-test-only comparison between two experimental groups, while statistically appropriate for the hypothesis tested, does not permit the same causal certainty as a randomised controlled trial with a passive control group and a pre-test covariate. Without a land-based-only control that received no resistance training, it is not possible to isolate the effect of the aquatic medium from the effect of resistance training per se. It is conceivable that any structured resistance programme, regardless of environment, would have improved free-throw performance relative to no training; the present design establishes the comparative superiority of the aquatic condition but not its absolute necessity. Second, the study does not report the reliability of the free-throw skill tests employed. Free-throw shooting is a closed skill with known day-to-day variability, and the absence of intra-class correlation coefficients or standard error of measurement data makes it difficult to determine whether the observed between-group differences exceed the threshold of meaningful change. International best practice in motor performance research recommends establishing test-retest reliability in the specific sample under investigation, particularly when the outcome is a fine motor skill subject to psychological influences such as anxiety and self-efficacy. Third, the mechanistic explanation offered – frictional resistance and gradual muscle strengthening – remains inferential. The study did not include electromyographic (EMG) or force-platform measures to directly quantify muscle activation patterns or kinetic chain coordination in the two environments. International research using EMG has shown that underwater muscle activity can differ significantly from dry-land activity, with amplitude decreases during maximal and submaximal contractions. Without such process-level data, the

pathway from aquatic resistance to free-throw improvement is plausible but not empirically traced in this study. Future research incorporating neuromuscular and biomechanical measures would strengthen the causal argument. Fourth, the training programme's duration and the absence of a retention test limit conclusions about the persistence of effects. International work on aquatic resistance training has demonstrated a "delay phenomenon" in strength and jumping performance, with some benefits emerging or consolidating only after a period of detraining. If the free-throw improvements observed here are similarly subject to delayed expression or, conversely, rapid decay, a single post-test assessment may misrepresent the true training effect. A follow-up assessment after two to four weeks would have clarified whether the aquatic advantage is transient or durable. Finally, the study does not report participant characteristics in sufficient detail to assess whether the groups were comparable at baseline on variables known to influence free-throw performance, such as basketball playing experience, prior free-throw accuracy, upper-limb strength, and visual acuity. While random assignment to groups mitigates this concern in expectation, the relatively small sample sizes typical of such intervention studies increase the risk of chance imbalance. The absence of baseline skill data is a notable limitation for a study whose primary outcome is a sport-specific skill.

The findings carry implications for several theoretical frameworks that inform skill acquisition and transfer. The most immediate is the specificity of practice hypothesis, which holds that learning is most effective when practice conditions closely approximate the conditions of performance. On a strict reading of specificity, training in water a medium with fundamentally different mechanical and sensory properties from a basketball court should produce poor transfer to dry-land free-throw shooting. Yet the present study found the opposite: the aquatic group outperformed the land-based group on the transfer task. This apparent paradox invites a more nuanced theoretical interpretation. One resolution lies in distinguishing between the surface of practice and the information-processing demands of the task. The free throw requires the calibration of force output to a consistent distance, the maintenance of postural stability during a ballistic movement, and the regulation of arousal under a closed-skill condition. The aquatic environment may function as a perturbation-training medium that enhances the learner's capacity to stabilise these parameters under varying afferent conditions. This resonates with the concept of variability of practice, which posits that practice under varying conditions promotes the development of a more generalisable motor schema or, in more contemporary terms, a robust and adaptable internal model of the task. The resistance and buoyancy of water introduce a form of variability that is not random noise but structured challenge, requiring the motor system to solve the force-production problem under constraints that differ from those of the performance context. The resulting adaptation may be a more flexible and resilient movement representation that transfers positively to the dry-land free throw. A second theoretical lens is the specific-motor-programme hypothesis and its extensions, including the concept of an especial skill (eGMP) for the free throw. Research on the free throw has suggested that extensive

practice from the standard distance may lead to the emergence of a distance-specific motor programme that does not generalise fully to nearby distances. The present study's finding that aquatic resistance training improved free-throw performance could be interpreted as evidence that the aquatic medium enriched the parameter specification of the free-throw programme rather than creating a competing, context-bound programme. By challenging the effector system with novel resistive and buoyant forces, the aquatic training may have forced the learner to explicitly or implicitly recalibrate the force-velocity-accuracy relationships that underpin the free throw. When returned to the dry-land court, this recalibrated parameterisation could manifest as improved accuracy. This interpretation shifts the theoretical emphasis from the context of practice to the parameters of the skill that are being trained, suggesting that the aquatic environment is valuable not because it mimics the court but because it perturbs the parameters in a way that refines their specification. A third implication concerns neuromuscular specificity and the transfer gradient. The principle of neuromuscular specificity predicts that training adaptations are greatest for the task and contraction type that are trained. Aquatic resistance training, with its velocity-dependent drag forces, imposes a different contraction profile from land-based court training, which is dominated by impact and stretch-shortening cycle loading. The transfer observed here suggests that the free throw a skill that is neither purely ballistic nor purely strength-dependent may benefit from a training stimulus that develops the capacity for graded force production under externally imposed resistance. This is consistent with the idea that the free throw is a hybrid skill requiring both proximal stability and distal precision, and that the aquatic medium trains the proximal stabilisers in a way that the hard/rubber court condition does not. The theoretical contribution of the present study is therefore to suggest that the transfer gradient from aquatic to dry-land skill performance is not uniformly negative but is contingent on the fit between the demands of the transfer task and the adaptations induced by the aquatic medium. In synthesis, the present findings align with international evidence that the aquatic environment is a viable and potentially superior training modality for basketball-specific qualities, while also surfacing theoretical tensions with strict specificity accounts. The most productive theoretical interpretation is one that treats the aquatic medium as a constraint-led perturbation that enriches the motor schema and refines parameter specification for the free throw, rather than as a context to be matched to the performance environment. Future research that combines process-level measures with transfer designs across multiple skill classes will be necessary to test this proposition and to establish the boundary conditions of aquatic-to-land transfer in precision sports.

D. Conclusions

This study concludes that strength training conducted in an aquatic environment produces a positive effect on developing physical abilities related to basketball scoring and dribbling, and that this effect is superior to strength training performed on basketball courts, whether hard or rubber surfaces. Significant differences emerged

between the court-based training groups and the aquatic training group, with the aquatic group demonstrating greater benefits in shooting skill development and ball-handling strength. These findings indicate that the unique properties of water including buoyancy, hydrostatic pressure, and variable resistance can be effectively harnessed to enhance sport-specific strength qualities that transfer to basketball performance. The results therefore support the use of aquatic strength training as a complementary or alternative conditioning method for developing shooting and dribbling capabilities, rather than relying exclusively on conventional hard-court or rubber-court training environments. Coaches and physical education practitioners should consider incorporating aquatic strength training into basketball conditioning programs, particularly when aiming to improve shooting accuracy and ball-handling strength while reducing joint impact and injury risk associated with land-based training. Aquatic sessions can be periodized alongside court-based work, using water resistance to target upper-body and core strength specific to shooting mechanics and dribbling control. Practically, this approach may be especially valuable for athletes recovering from injury, younger players requiring low-impact loading, or teams with limited access to specialized strength equipment. Coaches should ensure that aquatic exercises are progressively overloaded and closely matched to basketball movement patterns to maximize transfer to competitive performance. Future research should replicate this investigation across larger and more diverse samples, including different age groups, skill levels, and competitive standards, to test the robustness and generalizability of the findings. Studies should compare varied aquatic training protocols differing in depth, resistance equipment, and session duration to identify optimal dosage. Researchers should also examine retention effects after training cessation and transfer to actual game performance metrics. Conducting similar studies on other sporting activities and motor skills is recommended to determine whether aquatic strength training offers comparable advantages across different sports domains, thereby building a broader evidence base for sport-specific aquatic conditioning.

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F. Author Contributions

Yosra Hasoon Motashar contributed to the design concept and implementation of the research, analysis of the results, and writing of the final manuscript. Afrah Abelqader Abbas were involved in planning and supervising the work, processed the data, performed the analysis, drafted the manuscript, and designed the figures. Adnan Mohsin Abbood developed the theory and verified the analytical method. Afrah Abelqader Abbas also investigates and supervises the findings of this study. All authors discussed the results and contributed to the final manuscript.

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H. Data availability

All data generated or analysed during this study are included in this published article.

I. Declarations

Ethics approval and consent to participate

The study was approved by the Ethics Committee of the Al- Qadisiyah University, Iraq. The study was conducted in agreement with the guidelines governing research involving human participants, as outlined by the Ethics Committee of the Al- Qadisiyah University, Iraq.

J. Competing Interests

The authors declare no competing interests

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