



ORIGINAL ARTICLES. SPORT

Effect of Aquatic Plyometric Training on Motor Ability in Youth Football Players

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DOI: <https://doi.org/10.34142/HSR.2021.07.01.06>

How to Cite

Shimal H Chomani, Abdulla M Dzay, Karzan K khoshnaw, Marko Joksimovic, Ana Lilic, Arazw Mahmood. Effect of aquatic plyometric training on motor ability in youth football players. *Health, Sport, Rehabilitation*. 2020;6(4):47-57. <https://doi.org/10.34142/HSR.2021.07.01.06>

Abstract

Purpose: to determine the effect of water plyometric training on such components of motor skills as explosive power, agility and speed in young players. Develop practical recommendations for building a training process to improve the motor skills of athletes.

Material and methods: when divided into groups of players was used a parallel randomized method with the creation of experimental and control equal groups of 20 players in each group (age 16.25 ± 1.0 years, height 168 ± 3.0 cm, body weight $61, 03 \pm 4.0$ kg). The duration of the experimental program was 2 months. The water plyometric training program (APT) was used in the experimental group, while the ground plyometric training program (LPT) was used in the control group.

Results. In the experimental group was found to increase the jump in height by 21.05%, long jump - by 8.84%. The experimental group also found a significant increase in dexterity by 9.35% with a significance level less than 0.05, a value of $t = 7.19$. Dexterity as a physical ability combines many other physical abilities, such as speed, strength, power. In the experimental group was also found a significant increase in speed by 12.50% at a significance level less than 0.05.

Conclusions. Plyometric training in the water increased the strength of the muscles of the legs of football players, while the majestic vertical jump increased by 21.05%, and the distance of the horizontal jump - by 8.84%. In addition, for 2 months, the training program contributed to the development of dexterity by 9.35% and an increase in speed by 12.50%. The use of ground plyometric training also improves physical abilities, but with fewer indicators of significant change than plyometric training in water.

Key words: water plyometric training, motor abilities, young football players



Анотація

Мета: визначити вплив водних плиометрических тренувань на такі компоненти рухових здібностей, як вибухова сила, спритність і швидкість у юних футболістів. Розробити практичні рекомендації з побудови тренувального процесу для підвищення рухових здібностей спортсменів.

Матеріал і методи: при розподілі на групи гравців був використаний паралельний рандомізований метод зі створенням експериментальної та контрольної рівних груп по 20 гравців в кожній групі (вік $16,25 \pm 1,0$ років, зріст $168 \pm 3,0$ см, маса тіла $61,03 \pm 4,0$ кг). Тривалість експериментальної програми становила 2 місяці. Програма водного плиометричного тренування (АРТ) застосовувалася в експериментальній групі, в той час як програма наземної плиометричного тренування (LPT) застосовувалася в контрольній групі.

Результати. В експериментальній групі було виявлено збільшення стрибка у висоту на 21,05%, стрибка в довжину - на 8,84%. В експериментальній групі було також виявлено достовірне збільшення показника спритності на 9,35% при рівні значущості менше 0,05, значення $t = 7,19$. Спритність як фізична здатність поєднує в собі багато інших фізичних здібностей, таких, як швидкість, сила, потужність. В експериментальній групі було також виявлено достовірне збільшення показателя швидкості на 12,50% при рівні значущості менше 0,05.

Висновки. Пліометричне тренування в воді збільшило силу м'язів ніг футболістів, при цьому величина вертикального стрибка збільшилася на 21,05%, а відстань горизонтального стрибка - на 8,84%. Крім того, протягом 2 місяців тренувальна програма сприяла розвитку спритності на 9,35% та збільшенню швидкості на 12,50%. Застосування наземного плиометричного тренування

Ключові слова: водна плиометрична підготовка, рухові здібності, молоді футболісти

Аннотация

Цель: определить влияние водных плиометрических тренировок на такие компоненты двигательных способностей, как взрывная сила, ловкость и скорость у юных футболистов. Разработать практические рекомендации по построению тренировочного процесса для повышения двигательных способностей спортсменов.

Материал и методы: при распределении на группы игроков был использован параллельный рандомизированный метод с образованием экспериментальной и контрольной равных групп по 20 игроков в каждой группе (возраст $16,25 \pm 1,0$ лет, рост $168 \pm 3,0$ см, масса тела $61,03 \pm 4,0$ кг). Продолжительность программы составляла 2 месяца. Программа водной плиометрической тренировки (АРТ) применялась к экспериментальной группе, в то время как программа наземной плиометрической тренировки (LPT) применялась в контрольная группе.

Результаты. В экспериментальной группе было выявлено увеличение прыжка в высоту на 21,05%, прыжка в длину – на 8,84%. В экспериментальной группе было также выявлено достоверное увеличение показателя ловкости на 9,35% при уровне значимости меньше 0,05, значение $t=7,19$. Ловкость как физическая способность сочетает в себе многие другие физические способности, такие как скорость, сила, мощность. В экспериментальной группе было также выявлено достоверное увеличение показателя скорости на 12,50% при уровне значимости меньше 0,05.

Выводы. Плиометрические тренировки в воде увеличивают силу мышц ног футболистов, при этом величина вертикального прыжка увеличилась на 21,05%, а расстояние горизонтального прыжка - на 8,84%. Кроме того, в течение 2 месяцев тренировочная программа способствовала развитию ловкости на 9,35%, увеличение скорости – на 12,50%. Применение наземной плиометрической тренировки также улучшает физические способности, но с меньшим количеством показателей достоверного изменения, чем плиометрическая тренировка в воде.

Ключевые слова: водная плиометрическая тренировка, двигательные способности, юные футболисты



Introduction

Plyometric is a conditioning technique that was originally used by track and field athletes but is now used by athletes in all forms of sports to improve strength and explosiveness [1]. Plyometrics is a form of muscle training that requires a rapid stretch of the muscle accompanied by an eccentric contraction of the same muscle [2]. Aquatic plyometric training (APT) is a category of explosive bodyweight resistance movements using the increased force production afforded by the stretch reflex of a muscle to improve speed and strength. The recoil effect, when harnessed and trained correctly, can improve sports performance (speed, weight, and power) [3].

These types of physical activities are important to several sports such as football, basketball, and volleyball which can improve one's overall athletic performance [4]. plyometric training result training has been shown to increase leg mobility, joint-stability, power, muscle awareness, and general proprioception [5].

Plyometric training is an important aspect of physical conditioning with many significant advantages, including enhanced motor skills and performance [6]. Aquatic plyometric training is a good method for increasing the number and types of training opportunities, as well as the time needed to do the special exercises and even the special training durations, all of which produce high intensity. One of the characteristics of training in the water is to make the body stronger than air when one encounters resistance, to achieve greater movement at a greater depth, and to increase the strength of the joints when increasing the speed [7]. It is encouraged by water-based plyometric training to provide lower levels of muscle injury markers [6]. Even if the participants did the same amount of eccentric and concentric exercise, they had different loads, so it can be inferred that the adaptations to muscle injury mechanisms are quicker with lower loads [8]. Football is a game that requires practitioners to perform skills of certain specifications and accurate tech, the performance of those skills is related to special requirements and the most important of those requirements is the strength of speed, which the player uses directly in the performance of motor duties since it is one of the most important physical qualities on which the movements of the defender or the attacker (defenders, midfielders and strikers) as well as jumping, situations resulting from variable and sudden situations in the positions of play [9]. Football is a high-intensity, tactical

team sport with multiple touch circumstances between teams that changes course, and the chances of injuries are high [10]. The current practice of weightlifting plays a significant and significant role in training practices that help prepare football players for all kinds of competitive play, team activities, where at the high level we can find a true influence on the professional player's body composition which features an amazing amount of individual muscles [11], that the excellent football player who knows how to use a better foot, he knows how to run suddenly quickly, and how to deceive the opponent that he will be going in a direction and then change it, as he stands suddenly without slowing down gradually in his speed and focuses on the right foot, and for the player to use his feet in the right way must be the two men strong and agile movement, and be in control of the balance of his body always [1].

It is the strength characterized by the speed that can repeatedly overcome resistances using high kinetic speed and here it must be noted that the amount of force at that time is less than the maximum and also the amount of speed is less than the maximum even if it is very high [12]. Where the strength of the speed is to repeat without waiting for the assembly of the force, such as the rapid running of the fast-moving ball to penetrate [13]. This study aims to determine the Effects of aquatic plyometric training on a motor abilities such as explosive strength power, agility, and speed in young football players. Understand further about this research on a continuing search to include realistic recommendations for healthy and successful programming within a range of sports for fysical ability improvement.

Purpose: to determine the effect of water plyometric training on such components of motor skills as explosive power, agility and speed in young players. Develop practical recommendations for building a training process to improve the motor skills of athletes.

Material and Methods

Participant

The researcher used the experimental method of the two groups with the dimensional tribal design of two groups one experimental and the other controlled for the nature of this research, the duration of the program was Weeks program 3 time in the week, which started from (Dec 2020 to



Feb 2021) of Aquatic Plyometric Training (APT) was applied to the experimental group, while the Land Plyometric Training (LPT) program applied in the control group .Pre-test and post-test have been applied for measuring both groups (explosive power- vertical jump, explosive power-wide jump, agility, and speed). The Population of the study is football players under the 18 ages in football academics in Erbil city will be part of the population, the sampling will be 40 players in Fastlink football academic 20 for each group, (age $16.25 \pm 1,0$ years, height $168. \pm 3.0$ cm, body weight 61.03 ± 4.0 kg).

Statistical analysis

Using SPSS to analysis the data of the study, with version 21.

Implementing APT and LPT

1- Jumps-in-Place: These exercises require jumping and landing in the same place, and are of relatively mild intensity. The athlete's guidance to

her instrument is answered quickly in each jump and it executes one after the other with a phase of transformation.

2- Multiple hops and jumps, these exercises require maximum effort and are carried out one by one. It can be implemented without or using barriers in advanced forms of them, and must be carried out for a distance of less than (30m)

3- Standing Jumps: It is that the player stands and puts the ready or stand and feet wide chest and jumps to the highest point vertically or forward and answers to be comfortable and not repeat quickly like the previous exercise.

4- Box Drills: It combines multiple jumps and arguments with deep jumping and can be carried out with low or high intensity.

5- Regressive exercises (Bounding): These exercises are used in the development of step d and length of the step and typically perform these exercises for a distance of more than (30 m).

6- Deep Jumps: These exercises use body weight and gravity and are carried out in standing on the box and then landing on the ground and then trying to jump high at the level of the box, and because deep jumping exercises require high intensity so controlling the height of the fall helps in determining the severity.

Table 1

The intensity of the exercises used in the program is placed during the program weeks

No	Plyometric training exercise	Distribution of exercises depending on the intensity of the exercise on Number of weeks of the program							
		1	2	3	4	5	6	7	8
1	Jumping in the place with cod.	0	0	0					
2	side jumping	0	0	0					
3	Single jumping	0	0	0					
4	Front jumping	0	0	0					
5	jump with the exchange of putting the	0	0	0					
6	Jump with open and join the feet in	0	0	0					
7	Partridge on one foot in the place.								
8	Partridge on one foot in the place.				▲	▲	▲		
9	jump with the knees attached to the				▲	▲	▲		
10	jump with feet in place				▲	▲	▲		
11	Deep jump with feet as they move				▲	▲	▲		
12	deep jump in place with the exchange				▲	▲	▲		
13	forward on the box.				▲	▲	▲		
14	Jumping interchangeably feet on the							■	■
15	Side jump interchangeable feet on the							■	■
16	cross jumping							■	■
17	Step box							■	■

Notes: 0 Low-level exercises
▲ Medium-level exercises
■ High-level exercises



Table 2

Training load variables during the training program (8) weeks

Weeks	Total weekly volume	Number of exercise frequency	Rest between sets	Numbers of sets	Rest between set	units per week	Exercise per unit
1	672 jumps	14 rep	30 s	4	3-5 min	2	6
2	768 jumps	16 rep	30s	4	3-5 min	2	6
3	864 jumps	18 rep	30 s	4	3-5 min	2	6
4	480 jumps	10 rep	30 s	4	3-5 min	2	6
5	576 jumps	12 rep	30s	4	3-5 min	2	6
6	672 jumps	14 rep	30 s	4	3-5 min	2	6
7	280 jumps	7 rep	30 s	4	3-5 min	2	5
8	320 jumps	8 rep	30 s	4	3-5 min	2	5

Table 3

Indication of the differences between the experimental and control groups in physical Pre-tests

Variables	Unit	Experimental (APT) N=20		Survey (LPT) N=20		Validity of differences	
		M	SD	M	SD	t	p
Explosive power (vertical jump)	Cm	39.00	7.93	34.90	5.58	1.24	>0.05
Explosive power (wide jump)	Cm	214.30	10.65	204.40	9.58	1.97	>0.05
Agility	Sond	11.76	0.20	12.17	0.16	-1.39	>0.05

Results

Statistical analysis

Digital material obtained during the study was processed using traditional methods of mathematical statistics. We determined the Mean (M), mean different, standard deviation (SD), and t-test, the assessment of the significance between experimental and control group by students t-tes with the appropriate level od significance (p).

In the experimental group was found to increase the jump in height by 21.05%, long jump - by 8.84%. The experimental group also found a significant increase in dexterity by 9.35% with a significance level less than 0.05, a value of $t = 7.19$. Dexterity as a physical ability combines many other physical abilities, such as speed, strength, power. In the experimental group was also found a significant increase in speed by 12.50% at a significance level less than 0.05. Pre-and dimensional measurement of the experimental group (APT) are shown in the Table 4.



Table 4

Indication of the differences between tribal and dimension standards in the physical tests of the experimental group

Variables	Unit	Experimental pre-test		Experimental post-test		Means different			Percent age of improve ment
		N=20		N=20		M Differen t	±sd differen t	t value	%
		M	±SD	M	±SD				
Explosive power (vertical jump)	Cm	214.30	7.93	49.40	6.43	10.40	1.95	16.82*	21.05 -
Explosive power (wide jump)	Cm	11.76	10.65	235.10	9.07	20.80	3.79	*19.33	8.84
Agility	Sond	4.05	0.65	10.66	0.61	1.09	0.48	*7.19	9.35
Speed 30m	Sond	39.00	0.28	3.60	0.25	0.45	0.07	*18.00	12.50

*Where the table mount (t) value is at 0.05=2.26

Tribal and dimensional measurement of the control group (LPT) are shown in the Table 5.

Table 5

Indication of the differences between tribal and dimension standards in the physical tests of the control group

Variables	Unit	Control group pre-test		Control group post-test		Means different			Percentage of improvement
		N=20		N=20		M Differen t	±SD differen t	t value	%
		M	±SD	M	±SD				
Explosive power (vertical jump)	Cm	34.90	5.58	41.10	6.52	6.20	1.61	*12.10	15.08
Explosive power (wide jump)	Cm	204.40	9.58	218.10	8.14	13.70	3.16	*13.69	6.28
Agility	Sond	12.17	0.52	11.50	0.57	0.66	0.31	*6.69	5.42
Speed 30m	Sond	4.26	0.36	4.03	0.33	0.23	0.05	*14.09	5.70

*Validity of differences at 0.05 where the table mount (t) is at 0.05=2.26

However, the difference between the tribal and dimension measurement of the LPT control group at 05.0 in all the physical tests in question in favor of dimension measurement, where the value of (t) in the vertical jump test (10.12) with an improvement rate of (15.08%) In the wide jump test, the value of (13.69) was 13.69. Strength of the speed of the vertical jump test (2.64) and the ratio of differences between averages amounted (3.14) in favor of the APT experimental group, the strength of the speed of the ratio of (t) in the wide jump test (3.94) and the ratio of differences

between averages amounted to (4.31) in favor of the APT experimental group. The distance measurement of the two research groups for the APT experimental group, which was used in the (aquatic plyometric training) in the fitness test where it reached the value of (t) in the Simo fitness test(2,4) . Finally, the measurement of the apt experimental group, which was used in the (aquatic plyometric training) in the speed test where it reached the value of (3.09).

Dimensional measurement of apt and LPT experimental groups are shown in the Table 6.



Table 6

Indication of differences between the dimension measurements of APT and LPT groups in physical tests

Variables	Unit	Experimental (APT) N=20		Survey (LPT) N=20		Means different	t	Percent age of differences%
		M	±SD	M	±SD			
Explosive power (vertical jump)		49.40	6.43	41.10	6.52	3.14	2.64*	16.80
Explosive power (wide jump)		235.10	9.07	218.10	8.14	4.31	3.94*	7.23
Agility		10.71	0.59	11.51	0.57	0.23	*2.42	7.46
Speed 30m		3.60	0.25	4.03	0.33	0.13	*3.09	11.94

*Validity of differences at 0.05 where the table mount (t) is at 0.05=2.05

Discussion

This speed improvement is due to the development of the strength of the muscles of the legs. Since the strength of the speed is a combination of the element of speed and power, therefore the improvement of the strength of the characteristic speed thus leads to the improvement of the maximum speed [14], [15] and [16].

The researchers attribute this improvement in the measurements of strength characterized by speed to the impact of the training program using the training of plyometric supplement, the exercises plyometric aims to produce the greatest force in the shortest possible time where the time of contact of the feet is shortened to the ground at the moment of elevation and produce the greatest force contraction in the working muscles, [17]. leading to the improvement and development of the strength and speed of muscle contraction and thus increase the distance of vertical jump and a broad jump of stability [18], [19]

This is because of the development that occurred in the strength of the characteristic speed as a result of the training of the polymetric to the development of agility, which was confirmed by the study of both [20, 21].

The maximum central force when making one-leg static jumps in the water was 44.9 percent higher. Of its value on the ground at ($p < 0.05$), for the central RFD, it was higher by (30.4%) When making jumps in water compared to its value when making jumps on the ground at a Validity of differences value ($p < 0.05$), there was a Validity of differences decrease in peak impact force when making jumps in the water compared to jumping on the ground at ($p < 0.05$), the practice of jumps in the water showed a Validity of differences decrease in RFD value compared to the same jumps on the ground at ($p < 0.05$), the value of impact force in landing decreased (44.8%) When jumping in the water, the mean impact force of participants was 2.38 body mass on dry land, while the body mass was 1.31 in the water medium. The total jumping time was shorter at ($p < 0.05$) when making jumps



in the water, while there was no Validity of differences difference in the time needed to reach maximum central strength than when jumping on the ground, despite the great resistance to movement in the water medium [22].

According training in the water and cold therapy can improve the imbalance between various muscle groups, as well as improve the mechanics of movement of the foot joint, the advantages of training in the water is the hot and refreshing impact on the player's body, training out of water increases the body temperature quickly when in the water temperature is rapidly reduced. Accordingly, [23]. is considered the best natural environment, where it acts as a medium that calls for a feeling of relaxation, as increased water resistance works to raise and improve the level of the player from the skill side and the functional aspect, as shown its real importance in improving the imbalance between different muscle groups, as well as improving the process of power transfer and mechanical movement of the foot join [24]. also, pelog et al mentioned that exercise in the water environment enhances stamina, improves cardiac function, and is beneficial for all parts of the body as it decreases muscle strain on ligaments and joints as water resistance increases overall work speed and water activity increases [25].

APT exercises demonstrated a Validity of differences increase in dorsiflexion ankle movement's highest torque, but there are no Validity of differences discrepancies regarding LPT [26]. However, the ATP exercises may be an alternative and effective program to increase

agility. The viscosity of water and the cohesion of its molecules increase this resistance, thus providing an important stimulus for agility [27]. The combined effect of both speeds, frequent training, and shortening of vertical jumping task installments can lead to increased agility, APT exercises have shown a Validity of differences improvement in the running performance of university soccer players than the improvement in the LPT group, for the T-test test, APT group and LPT group have shown a Validity of differences improvement in tribal and dimensional testing in male and female university students [28].

Conclusions

Plyometric training in the water increased the strength of the muscles of the legs of football players, while the majestic vertical jump increased by 21.05%, and the distance of the horizontal jump - by 8.84%. In addition, for 2 months, the training program contributed to the development of dexterity by 9.35% and an increase in speed by 12.50%. The use of ground plyometric training also improves physical abilities, but with fewer indicators of significant change than plyometric training in water.

Conflict of interest

The authors declare that there is no conflict of interest.

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Received: 2020-12-17 Accepted: 2021-02-12 Published: 2021-03-20