Journal of
Osteoporosis & Physical Activity

OPEN ACCESS Freely available online

Research Article

Relationship between Aquatic Plyometric Training and Injuries Prevention

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ABSTRACT

Aims: To determine the relationship of aquatic plyometric training on injuries prevention and to effects on physical fitness components 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 performance improvement and injury prevention.

Methods: Experimental Method with experimental and control equal groups 20 players for each group duration of the program was 2 months program of Aquatic Plyometric Training (APT) was applied to the experimental group, while the Land Plyometric Training (LPT) program applied in the control group comparing injury players during program and after between APT and LPT (Age 16.25 ± 1, height 168 ± 3 cm, body weight 61.03 ± 4.kg).

Results and Conclusion: Land plyometric training can be improved physical ability, but fewer effects than the APT. The success of APT increase gain edging out the increases in the LPT program, and the incidence of fewer muscle injuries and less pain, the effects of LPT and APT on muscle injury and pain were tested by assessing the pain of straight muscles and lower body injuries, it means that by aquatic plyometric training can be the prevention of the lower body injuries during the program training and competitions. This difference is attributed to the development of the APT experimental group in the special force at a rate that exceeds the LPT, which in turn led to a difference between the two groups and for the benefit of the APT group, which used the aquatic polymeric training.

Keywords: Aquatic plyometric training APT; Injuries prevention; Football players

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]. Plyometric is a form of muscle training that requires a rapid stretch of the muscle accompanied by an eccentrical 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 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, but it can also enhance serum muscle injury, collagen degradation, muscle swelling, and soreness [6]. Owing to the influence of water, plyometric training in water offers less eccentric contraction, encourages quicker movement from the eccentric process of a leap, and provides greater resistance during concentric contraction with acute lower indices of muscle injury [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]. Many researchers have established correlations between football player injuries. Intrinsic risk factors are understood to be the individual biological and psychosocial features of a person, such as joint

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Received: Feb 26, 2021; **Accepted:** Mar 17, 2021, **Published:** Mar 24, 2021

Citation: Chomani SH, Dzai AM, Khoshnaw KK, Joksimovic M, Lilic A, Mahmood A (2021) Relationship between Aquatic Plyometric Training and Injuries Prevention. J Osteopor Phys Act. 9:241. doi: 10.35248/2329-9509.21.9.241

stability, prior injuries, and incomplete recovery [9]. All the extrinsic factors deal with factors such as the amount of preparation and number of games played, climatic factors, pitch surface, playing field conditions (for example, dry, rainy, uneven), equipment (for example, shin guards, taping, shoes), and foul 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]. Injuries are correlated with various negative effects for the athlete and the team, the club, and the culture. Potential short- and long-term negative effects include hospital care and related costs, decreased productivity, the progression of osteoarthritis, lack of self-esteem, and long-term brain injury [11].

the explosive essence of plyometric workouts. While there are many advantages associated with the high-impact, high-intensity land-based plyometric activity, the risk remains for the damage or injury to muscles, bones, or joints [12]. In tandem with existing recovery, land-based plyometric exercise will likely need to be postponed until such a time that it could be safely integrated into a training schedule [1].

Injuries are triggered by sudden exposure to elevated levels of energy as a result of a deficit is a critical factor that surpasses normal physiological thresholds. They are typically categorized as planned or accidental [13]. Injuries are a major health problem because they cause more than 5 million deaths each year, mainly in developing countries, and they result in more than 100 million injury years annually [14]. Focusing on avoiding injury as well as deaths, a prevalent myth occurs that injuries are considered to be the same as accidents; moreover, accidents are largely used as chance events, without taking in mind that all these are preventable [15]. This study aims to determine the comparative between aquatic plyometric training and injury prevention and to compare it to physical capacities 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 performance improvement and injury prevention.

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 8 Weeks program 3 time 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) and comparison between both groups during two months training program who got injuries, the test has been for both groups in the same conditional environment. 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 fast link football academic 20 for each group, (age 16.25 ± 1, and height 168. ± 3 cm, body weight 61.03 ± 4 kg).

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 30 m.
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 help in determining the severity (Tables 1 and 2).

Statistical analysis

The data were analyzed by the SPSSS Social Science Statistical Kit (v22.0, SPSS Inc., Chicago, IL, USA). In the first step, descriptive parameters and the distribution of variables are decided by the simple ones. For both measures, central and dispersive parameters were calculated: arithmetic mean (mean), standard deviation (SD), and mean confidence interval (Lower and Upper). Via two methods, the normality of the distribution of the variables was derived: the asymmetries of the results of Skewness and the homogeneity of the results of Kurtosis. To assess the effect and estimation of body structure parameters with the effects of anaerobic strength of the lower extremities, linear regression analysis was applied. $P<0.05$ was the statistical importance of the observations (Table 3).

It is clear from the table 3, that there are no moral differences between the experimental and control groups in the physical tests in the football juniors before the beginning of the trial, where the value of the calculated t ranged between 0.68 to 1.97 which is less than the value of the tablet at the level of 0.05, which indicates the parity of the two groups before the beginning of the trial.

Pre-and dimensional measurement of the experimental group (APT)

The Table 4 that there are moral differences between the tribal and dimension standards in the physical and skill tests of the experimental group football junior at 0.05 in all tests, where the calculated value ranged from 5.89 to 19..33 which is greater than the scheduled value at 0.05, indicating the impact of the proposed program applied to the experimental group and the rate of improvement ranged from 6.01% to 21.05%. In the interest of dimensional measurement in improving some of the physical and skill elements in question (Table 4).

Tribal and dimensional measurement of the control group (LPT)

It is clear from the table 5, that there are moral differences between the tribal and dimension standards in physical and skill tests (in the

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.	O	O	O					
2	Side jumping	O	O	O					
3	Single jumping	O	O	O					
4	Front jumping	O	O	O					
5	Jump with the exchange of putting the feet in front of the place	O	O	O					
6	Jump with open and join the feet in place	O	O	O					
7	Partridge on one foot in the place.				▲	▲	▲		
8	Jump with the knees attached to the chest in place				▲	▲	▲		
9	jump with feet in place				▲	▲	▲		
10	Deep jump with feet as they move forward				▲	▲	▲		
11	Deep jump in place with the exchange of feet in front of us				▲	▲	▲		
12	Forward on the box.							▬	▬
13	Jumping interchangeably feet on the box							▬	▬
14	Side jump interchangeable feet on the box							▬	▬
15	Cross jumping							▬	▬
16	Step box							▬	▬

O 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 exercise	Numbers of sets	Rest between set	units per week	Exercise per unit
1	672 jumps	14 rep	30sec	4	3-5 mins	2	6
2	768 jumps	16 rep	30sec	4	3-5 mins	2	6
3	864 jumps	18 rep	30 sec	4	3-5 mins	2	6
4	480 jumps	10 rep	30 sec	4	3-5 mins	2	6
5	576 jumps	12 rep	30sec	4	3-5 mins	2	6
6	672 jumps	14 rep	30 sec	4	3-5 mins	2	6
7	280 jumps	7 rep	30 sec	4	3-5 mins	2	5
8	320 jumps	8 rep	30 sec	4	3-5 mins	2	5

Table 3: Indication of the differences between the experimental and control groups in physical tests pre-test.

Variables	Unit	Experimental (APT) N=20		Survey (LPT) N=20		Means different	t
		M	SD	M	SD		
Explosive power (vertical jump)	Cm	39.00	7.93	34.90	5.58	4.1	1.24
Explosive power (wide jump)	Cm	214.30	10.65	204.40	9.58	9.9	1.97
Agility	Second	11.76	0.20	12.17	0.16	-0.41	-1.39
Speed 30 m	Second	4.05	0.08	4.26	0.11	-0.20	-1.34

*Scheduled (t) value at 0.05=2.10

junior football) of the control group at 0.05 in all tests, where the calculated value ranged from 6.15 to 23.12 which is greater than the scheduling value at 0.05, indicating the effect of the traditional program applied to the control group and the improvement ranged from 2.71% to 15.05. For the benefit of dimensional measurement in improving some of the physical and skill elements in question (Table 5).

Dimensional measurement of apt and LPT experimental groups

Table 6 shows that there are moral differences between the experimental and control groups in physical tests in the football juniors after the trial was carried out at 0.05 where the calculated value ranged from 2.18 to 3.94, which is greater than the

Table 4: Indication of the differences between tribal and dimension standards in the physical tests of the experimental group.

Variables	Unit	Experimental pre-test N=20		Experimental post-test N=20		Means different		T value	Percentage of improvement
		M	SD±	M	SD±	M Different	SD± Different		%
Explosive power (vertical jump)	Cm	214.30	7.93	49.4	6.43	10.40	1.95	*16.82	-21.05
Explosive power (wide jump)	Cm	11.76	10.65	235.10	9.07	20.8	3.79	*19.33	8.84
Agility	Second	4.05	0.65	10.66	0.61	1.09	0.48	*7.19	9.35
Speed 30 m	Second	39	0.28	3.6	0.25	0.45	0.07	*18.00	12.5

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

Table 5: Indication of the differences between tribal and dimension standards in the physical tests of the control group.

Variables	Unit	Experimental pre-test N=20		Experimental post-test N=20		Means different		T value	Percentage of improvement
		M	SD±	M	SD±	M Different	SD± Different		%
Explosive power (vertical jump)	Cm	34.90	5.58	41.1	6.52	6.2	1.61	*12.10	15.08
Explosive power (wide jump)	Cm	204.40	9.58	218.1	8.14	13.70	3.16	*13.69	6.28
Agility	Second	12.17	0.52	11.50	0.57	0.66	0.31	*6.69	5.42
Speed 30m	Second	4.26	0.36	4.03	0.33	0.23	0.05	*14.09	5.70

*Moral at 0.05 where the tables mounts (t) is at 0.05=2.26.

Table 6: Indication of differences between the dimension measurements of APT and LPT groups in physical tests.

Variables	Unit	Experimental (ATP) N=20		Survey (ATP) N=20		Means different	t	Percentage of differences
		M	SD	M	SD			%
Explosive power (vertical jump)	Cm	49.40	6.43	41.1	6.52	3.14	*2.64	16.8
Explosive power (wide jump)	Cm	235.1	9.07	218.1	8.14	4.31	*3.94	7.23
Agility	Second	10.71	0.59	11.51	0.57	0.23	*2.42	7.46
Speed 30 m	Second	3.6	0.25	4.03	0.33	0.13	*3.09	11.94

*Moral at 0.05 where the table mounts (t) is at 0.05=2.05

Table 7: Comparative between both program training and injuries from experimental and survey groups during and after a training program.

Variables	N	Injuries	Percentage
ATP players	20	1	5%
LTP players	20	5	25%

scheduling value at 0.05, indicating the impact of the program and the differences between 4.45% to 16.80% for the benefit of the experimental group (APT), this indicates the effectiveness of the training program within the water center about the training program outside the water center (Table 6).

Table 7 showing the comparing differences in both experimental and survey group training between during training program which single player from APT and five players in LPT has been got an injury from 5% in APT and 25% in LPT. We know that the APT intensity is higher than LPT, but can be reduced weight body if did any mistake during training plyometric injuries not be happen.

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 [16-18].

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 [19]. 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 [20,21].

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 [22,23].

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 moral value p<0.05, there was a moral 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 moral 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 moral 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 [24].

According to 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. 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 [25,26]. also, Ploeg 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 [27].

APT exercises demonstrated a moral increase in dorsiflexion ankle movement's highest torque, but there are no moral discrepancies regarding LPT [28]. 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 [29]. 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 moral 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 moral improvement in tribal and dimensional testing in male and female university students [17,30].

RESULTS

In the measurement of (vertical jump) of stability 16.82 with an improvement 21.05% in the measurement of the (broad jump) of stability, the value of (t) 19.33 was an improvement 8.84%. That there is a moral difference at the level of 05.0 in favor of the dimension measurement in the measurement of agility where the value of (t) 7.19 with an improvement rate reached 9.35%, due to the agility of the physical abilities that combine many other physical abilities such as speed, strength, compatibility, and others, as indicated. There are moral differences at 05.0 in favor of telemetry in the variable of the transition speed, with an improvement of 12.50% (T) 12.50% in favor of measuring the dimension. 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 2.42. 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 (T) 3.09.

CONCLUSIONS

The aquatic polymeric training could increase the strength of the muscles of the legs to the football players, where the vertical jump distance improved by 21.05%, and the distance of the horizontal jump 8.84%. Also, during 1 month training program developed 9.35% fitness, increase 12.50% of the transition speed of football youth players. And the result showed that Performed land plyometric training can be improved physical ability, but with fewer effects than the APT. That the success of APT increase gain edging out the increases in the LPT program, and the incidence of fewer muscle injuries and less pain, the effects of LPT and APT on muscle injury and pain were tested by assessing the pain of straight muscles and lower body injuries, it means that by aquatic plyometric training can be the prevention of the lower body injuries during the program training and competitions. This difference is attributed to the development of the APT experimental group in the special force at a rate that exceeds the LPT, which in turn led to a difference between the two groups and for the benefit of the APT group, which used the aquatic polymeric training.

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