La riatletizzazione in acqua dello sportivo: quando e come

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Riatletizzazione

Nella riabilitazione sportiva, costituisce l'ultima fase delle attività di recupero funzionale dell'atleta, nella quale si mira a raggiungere il completo recupero delle capacità condizionali, delle abilità sport-specifiche (tecniche) e dell'efficienza di rendimento dello stesso



Stefano Boldrini
CORRISPONDENTE DA LONDRA

C'è già una frase virale a glorificare il ritorno in campo di Zlatan Ibrahimovic, entrato al 77' del match di sabato contro il Newcastle, 4-1 per il Manchester United e tanti saluti di Mourinho al vecchio nemico Rafa Benitez: «I leoni non recuperano come gli esseri umani». Ibra leone, immagine e parole destinate a entrare nel repertorio delle frasi celebri del fuoriclasse svedese: «Non è stato facile, soprattutto nel mio caso. Ero al top e mi sono trovato a fare i conti con un infortunio grave in un attimo. Ho trascorso un'estate diversa rispetto a quelle alle quali ero abituato. Sono stato costretto ad affrontare un lavoro e un percorso nuovo. Firmare il nuovo contratto con il Manchester United mi ha dato uno scopo ben preciso. Il mio obiettivo è diventato tornare, a tutti i costi. Non solo tornare, ma tornare al top. Mi sono allenato bene ed eccomi qui. Sono contento di poter giocare ancora e voglio ringraziare molte persone che mi hanno sostenuto in questi sette mesi: la famiglia, i compagni di squadra, tutto lo staff dello United, Mino Raiola, i tifosi. Ora il peggio è passato. Devo solo spingere per migliorare. Voglio sempre di più».

CACCIA AL CITY Anche Mourinho, «l'uomo per il quale puoi anche uccidere» come disse una volta Zlatan a proposito del portoghese, si è emozionato per il ritorno dell'attaccante svedese: «E' una gioia per tutti. E' stato un momento di grande suggestione rivederlo in campo». Il ritorno di Ibra è una carta in più per il Manchester United, nel tentativo non facile di rimontare gli otto punti di distacco rispetto al City, leader incontrastato della Premier. C'è una data, che potrebbe essere lo spartiacque della stagione: il 10 dicembre. Quella domenica si giocherà all'Old Trafford il derby di Manchester. Mai come stavolta sarà

Ruggito Ibrahimovic «Recupero da leone» E Mou bracca il City

● Zlatan e il rientro dal lungo infortunio: «Non è stato facile, voglio tutto». City a +8 ma lo United adesso crede alla rimonta

BJSM Online First, published on June 2, 2015 as 10.1136/bjsports-2014-094569
Review

Strategic Assessment of Risk and Risk Tolerance (StARRT) framework for return-to-play decision-making

Ian Shrier

BJSM Online First, published on June 9, 2015 as 10.1136/bjsports-2015-094796
Editorial

Return to play and physical performance tests: evidence-based, rough guess or charade?

Eric J Hegedus,[1] Chad E Cook[2]

decision, it should come as no surprise that decisions made by practitioners vary greatly.[8] Returning to competitive play is the most complex form of function and achieving a successful return is multidimensional (involving both physical and non-physical milestones). Nonetheless, lessons from other clinical populations

2016 Consensus statement on return to sport from the First World Congress in Sports Physical Therapy, Bern

Clare L Ardern,[1,2,3] Philip Glasgow,[4,5] Anthony Schneiders,[6] Erik Witvrouw,[1,7]

Figure 1 The three elements of the return to sport (RTS) continuum.

1. Return to participation. The athlete may be participating in rehabilitation, training (modified or unrestricted), or in sport, but at a level lower than his or her RTS goal. The athlete is physically active, but not yet 'ready' (medically, physically and/or psychologically) to RTS. It is possible to train to perform, but this does not automatically mean RTS.
2. Return to sport (RTS). The athlete has returned to his or her defined sport, but is not performing at his or her desired performance level. Some athletes may be satisfied with reaching this stage, and this can represent successful RTS for that individual.
3. Return to performance. This extends the RTS element. The athlete has gradually returned to his or her defined sport and is performing at or above his or her preinjury level. For some athletes this stage may be characterised by personal best performance or expected personal growth as it relates to performance.

Box 2 Key take home messages regarding models that can guide return to sport (RTS)

- Considering the biological, psychological and social factors influencing the RTS decision and transition can assist the clinician to optimally contribute to the shared RTS decision (figure 4).
- The composition of, and roles within the decision-making team should be determined as early as possible.
- Members of the RTS decision-making team should be prepared to regularly share information among all relevant stakeholders.
- Regular assessments and review of goals should be scheduled.

Box 3 Key take home messages regarding the evidence for return to sport (RTS)

- Time to RTS varies independent of the type and severity of injury, reflecting the challenge in accurately predicting injury prognosis and RTS timelines.
- RTS decisions should always use information gathered from a battery of tests mimicking the reactive elements and the decision-making steps athletes use in real sport situations.
- Workload may be linked to reinjury, so should be taken into consideration when making RTS decisions.
- Psychological factors should be taken into account during rehabilitation and at the time the athlete is making the transition back to sport.
- Consensus is needed regarding the RTS criteria for common athletic injuries.

[CLINICAL COMMENTARY]

ERIC WATERS, MS, ATC/L, CES, CSCS[1]

Suggestions From the Field for Return to Sports Participation Following Anterior Cruciate Ligament Reconstruction: Basketball

REHABILITATION GOALS AND RETURN-TO-PLAY CRITERIA (PHASE 3 TO UNRESTRICTED ACTIVITY) FOLLOWING ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION IN A BASKETBALL PLAYER

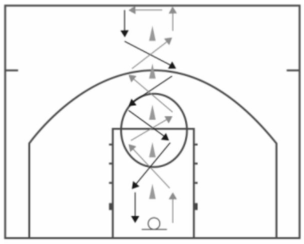
Phase 3 (Week 20 to Unrestricted Activity or When Return-to-Play Criteria Are Met)

Goals
- Continuance of phase 1 and 2 goals
- Continue strength, power, agility, basketball skill acquisition
- Continue functional strength and power enhancement
- Continue eccentric strength and force attenuation enhancement
- Progress basketball skill work, agility, and neuromuscular development
- Return to full basketball participation: cardiovascular testing, practice structuring, and game minutes allocation

Range of Motion (ROM) Criteria[7]
- Full knee extension bilaterally[16]
- 135° of flexion, while progressing to full flexion bilaterally, ideally heel to rear[28]

Strength Criteria
- Knee extension strength (isotonic): 90% of uninvolved side, 3-repetition maximum[19]
- Hamstring curl strength (isotonic): 90% of uninvolved side, 3-repetition maximum[19]
- Leg-press strength (isotonic): 90% of uninvolved side, 3-repetition maximum
- Single-leg squat test: 90% of uninvolved side, 10 repetitions with equal bilateral mechanics of uninvolved side with 18.14-kg weight vest and equal ROM depth of uninvolved side

FIGURE 1. Rotational squat, starting position.



IGURE 16. Zigzag drill. Sprint into a diagonal cut at 45° around each cone, with or without dribbling a asketball.

Rehabilitation Guidelines Following Proximal Hamstring Primary Repair

UW Health
University of Wisconsin Sports Medicine

***Figure 4:** Sutures extending out to the torn tendon stump from anchors placed in the ischial tuberosity (pelvic bone).*

***Figure 5:** Sutures tied off to approximate the torn tendon to the ischial tuberosity (pelvic bone).*

Return to sporting activities is permissible when isokinetic testing is 80% of the unaffected side, or both 5/5 with all LE MMT's. Similar to an ACL reconstruction, this will typically occur between 6 and 9 months.

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ScienceDirect
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Review

Rehabilitation and return to sport after hamstring strain injury

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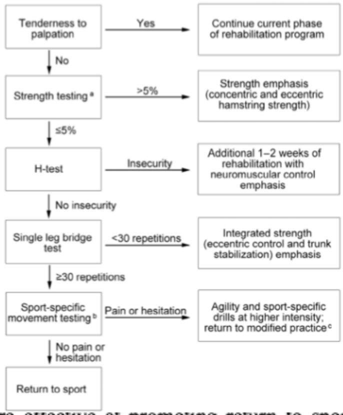
Available online 10 April 2017



training are more effective at promoting return to sport and minimize the risk of re-injury. Dynamic clinical and functional tests can be used to assess readiness for return to sport; however, an athlete should continue independent rehabilitation after return to sport to aid in minimizing re-injury risk.

The rehabilitation program


Basket > Verso gli Europei

Italia, torna Hackett Inizia il tour de force

● In campo dopo 8 mesi contro la Bielorussia: 12 partite in 28 giorni. Flaccadori e Zerini fuori, la rosa si riduce a 17

TACCUINO

IL NUMERO 33

The return to play

Physical Therapy in Sport 29 (2018) 70–78

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Case Studies

Return to competition after an Achilles tendon rupture using both on and off the field load monitoring as guidance: A case report of a top-level soccer player

Maurizio Fanchini [a, b, *], Franco M. Impellizzeri [c], Karin Grävare Silbernagel [d], Franco Combi [b], Franco Benazzo [e], Mario Bizzini [c, f]

Table 1
Criteria adopted to pass to successive phases and time of reaching.

Phase	Criteria to pass successive phase	Reached by
Controlling mobilization	Clinical and medical decision	
Early rehabilitation	Full weight bearing	Week 6
Late rehabilitation	Clinical and medical decision	Week 13
	Single heel raises test (3 × 10)	Week 14
	MRI	Week 15
	Running without pain	
RTS	Clinical and medical decision	Week 21
Return to sport	Ability to cope with previous injury training requests	Week 23
	Endurance single heel raises test (5 × 25)	Week 25
	Isokinetic assessment	Week 25
	MRI	
Return to team	Clinical and medical decision	Week 25
	No pain while team activity	
Return to performance	Clinical, medical and coach decision	Week 27

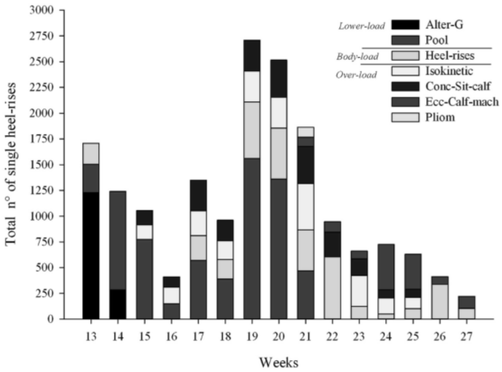

Fig. 1. Weekly distribution of the activities on the calf muscle.

CASE REPORT

Water and land based rehabilitation for Achilles tendinopathy in an elite female runner

A G Beneka, P C Malliou, G Benekas

Table 1 Water and land based rehabilitation programme for young female athlete with Achilles tendinopathy

Rehabilitation phase	Rehabilitation goals	Rehabilitation programme
Early phase (1st week)	Maintain cardiovascular endurance	Pool Swimming interval training
Sessions 1–4 (40 min)	Dorsiplantar flexion ROM improvement	Pool and land based ankle calf stretching
Sessions 5–7 (50 min)	Gait normalisation	Pool Walking (in different stride length, depths, speeds)
	Proprioception ability	Pool Ankle calf stretching Mild static balance & isometric exercises Wobble board training Single leg/balance
	Calf strengthening	Pool Open kinetic exercises Dynamic strength with special equipment for all the lower limb muscle groups
Intermediate phase (2nd week) Sessions 8–14 (60 min)	Maintain cardiovascular endurance	Pool Swimming interval training
	Increase gait endurance	Pool Mild dynamic strengthening (gastrocnemius & soleus) Gradually decreasing depths Land Progressively to fully weight bearing activities, focus on Achilles tendon
Late phase (3rd week) Sessions 15–21 (60–80 min)	Maintain cardiovascular endurance	Pool Swimming interval training
	More land based programme Specific event training skills	Pool Impact exercises Land Impact exercises in grass and gradually in track and field flooring Passive and active ankle calf stretching
Return to sport phase (4th–6th week) (60–90 min)	Back to training	Land Progressively augmented training intensity and volume

Training acquatico e return to sport

- L’allenamento in acqua può avere un ruolo ed essere utile nel programma di ritorno allo sport per l’atleta?
- Se sì, quando (in che fase) e come?
- Nell’ultima fase del programma di recupero (riatletizzazione) ha senso proporre esercitazioni in acqua?

IJSPT

CLINICAL COMMENTARY

RETURN TO SWIMMING PROTOCOL FOR COMPETITIVE SWIMMERS: A POST-OPERATIVE CASE STUDY AND FUNDAMENTALS

Tracy Spigelman, PhD, ATC[1]
Aaron Sciascia, MS, ATC, NASM-PES[2]
Tim Uhl, PhD, ATC, PT[3]

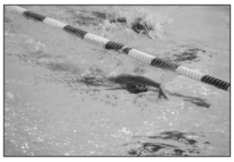

Figure 2. *Hand entry (right UE)*

Figure 4. *Late pull-through phase (right UE)*

Figure 3. *Early pull-through phase (right UE)*

Figure 5. *Recovery phase of the freestyle stroke. Note high elbow position.*

Table 3. *Key Points of the Return to Swimming Protocol (RTSP). Overview of the RTSP including the major components of a swimming workout and criteria for progression.*

	Phase I			Phase II – Join Team	
	Week One 1000-1500	Week Two 1500-2200	Week Three 2200-3000	Week Four 2800-3900	Week Five 3500-4700+
Warm Up	(300-400)	(600-700)	(700-900)	(900-1100)	(1000-1200)
Drills	Stroke Technique using drills (300-500)	Stroke Technique using drills (400-600)	Stroke Technique using drills Incorporate drills in the beginning and end of practice (600-700)	Incorporate drills in the beginning and at the end of practice (700-900)	A drill set should be incorporated at the end of the workout (800-1000)
Kick	With fins or zoomers, but no kick board Kick on side or back Arms can be at side or streamlined position if pain free (400 -600)	With fins or zoomers but no kick board Kick on side or back Arms can be at side or streamlined position if pain free (500 -900)	With fins or zoomers, but no kick board Kick on side or back Arms can be at side or streamlined position if pain free (700-900)	With fins or zoomers Kick board if comfortable Kick on side or back Arms can be at side or streamlined position if pain free (700-900)	Kick with board if pain free Or Kick in streamlined position, on side or supine with arms at sides Fins and zoomers are optional (700-900)
Intervals	None	None	1 set on interval at 70% effort 1 set on interval about 10 slower than regular practice pace (200-500)	Gradually increase number of sets with interval work Maintain correct stroke technique (500-1000)	Start on interval 5-10 sec slower than pre-injury pace, progress to pre-injury interval gradually Maintain correct stroke technique (800-1300)
Pull Set	None	None	None	None	Start pull set conservatively (200-300) Increase pulling yardage by 300 as tolerated DO NOT USE PADDLES! Stop immediately if pain or discomfort is felt.
Rest between repetitions	20-30 seconds for all	10-20 seconds for all	10-15 seconds between repetitions Interval 5-10 seconds rest Longer swims should have longer rest periods	10-15 sections between repetitions Interval 5-10 seconds rest Longer swims should have longer rest periods	5-15 sections between repetitions Interval 3-10 seconds rest Longer swims should have longer rest periods
Criteria to Progress	1.Pain free 2. Proper stroke technique during drills per coaches assessment a. Bent elbow recovery b. 4-6 beat kick c. Symmetrical body roll	1.Pain free 2.Proper stroke technique during drills per coaches assessment a. Bent elbow recovery b. 4-6 beat kick c. Symmetrical body roll	1.Pain free during and after practice 2. Ability to maintain good stroke technique at end of practice. 3. No shoulder pain during interval work	Join Team 1.Pain free during and after practice 2. Ability to maintain good stroke technique 3. No pain or discomfort during interval work	1.Completely pain free 2. Maintain stroke technique 3. Complete pull work pain free 4. No pain or discomfort during interval work

All distance is represented in yards.

Principles and Application of Hydrotherapy for Equine Athletes

Melissa King, DVM, PhD

KEYWORDS
- Hydrotherapy • Underwater treadmill exercise • Buoyancy • Osmolality
- Hydrostatic pressure • Viscosity

KEY POINTS

- Exercising in water is an effective treatment option for managing musculoskeletal injuries.
- Hydrotherapy provides an effective medium for increasing joint mobility, enhancing muscle activation, improving postural control, and reducing inflammation.
- Various forms of hydrotherapy are frequently prescribed for rehabilitation of equine musculoskeletal injuries with the goal of improving the overall function of the affected limb and preventing further injuries.

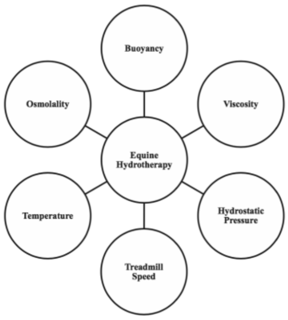

Fig. 1. Graph illustrating the combined variables involved in hydrotherapy.

Fig. 2. Hypertonic cold water bath. (*Courtesy of* ECB Equine Spa, Sparta, NJ; with permission.)

Clinical Review: Current Concepts

Aquatic Therapy: Scientific Foundations and Clinical Rehabilitation Applications

Bruce E. Becker, MD, MS

APPLICATIONS IN ATHLETIC TRAINING

There is a substantial volume of literature that supports the potential value of using aquatic exercise as a cross-training mode [130-133]. Much of the literature dealing with deep-water running with flotation belts concludes that skill levels determine maximal oxygen consumption, but that training levels can easily be achieved equal to land-based training [102,131-138]. It does need to be recognized that while aquatic cross training can present a very significant aerobic challenge to the athlete, there are differences in motor activity, muscle recruitment and cardiovascular performance

did not match the treadmill kinematics [145]. A 2006 study assessed aquatic training in plyometric performance, finding comparable performance improvement to land plyometric training but with reduced post-training muscle soreness, and of course decreased joint loading [146]. It is unlikely that aquatic training can substantially improve dry land performance in coordination skills such as hurdles, high jump, or other complex coordination activities, where reflex timing becomes a major part of the performance success. But for many athletic activities, aquatic cross-training can sustain or even build aerobic fitness, with the side benefits of reduced joint loading, decreased muscle soreness and improved performance, and a significant potential for improved respiratory function. Programs typically used for vertical water exercise include buoyancy-assisted deep water running and cross-country skiing, aquatic treadmill running, waist-depth aqua-running, and upper extremity work using resistive devices in cool pool environments.

PREGLEDNI ČLANAK
REVIEW

Hrvat. Športskomed. Vjesn. 2013; 28: 57-66

AQUATIC TRAINING – AN ALTERNATIVE OR A COMPLEMENT TO THE LAND-BASED TRAINING

TRENING U VODI – ALTERNATIVA ILI DOPUNSKA TRENING METODA KLASIČNOM TRENINGU SPORTAŠA

Vlatka Wertheimer, Igor Jukić

Faculty of Kinesiology, University of Zagreb

running. Also, the changes in neuromuscular status during others types of exercise in water are analyzed. There are possible benefits, as improving the physical fitness of an athlete and accelerating the post-game or post-training recovery which might be obtained during aquatic training. Water environment is also favorable for injured athletes during rehabilitation and also for other athletes that are experiencing interruptions in training process and competition programs caused by illness or other factors such as postseason break. Therefore, it is important to

A CASE FOR HYDROTHERAPY IN SPORT

This article presents the case for using hydrotherapy in sport in three different dimensions: treatment of sport injuries, maintenance of fitness during rehabilitation from injury, and prevention of sport injuries.

Journal of Human Kinetics volume 44/2014, 237-248 DOI: 10.2478/hukin-2014-0129 237
Section III – Sports Training

DE GRUYTER OPEN

The Properties of Water and their Applications for Training

by
Lorena Torres-Ronda[1], Xavi Schelling i del Alcázar[2]

The biological effects of immersion in water, which are related to the fundamental principles of hydrodynamics, may be beneficial in certain training contexts. The effects and physical properties of water, such as density, hydrostatic pressure and buoyancy are highly useful resources for training, when used as a counterbalance to gravity, resistance, a compressor and a thermal conductor. Not only does the aquatic medium enable a wider range of activities to be used in a context of low joint impact, but it also constitutes a useful tool in relation to sports rehabilitation, since it allows the athlete to return to training earlier or to continue with high-intensity exercise while ensuring both low joint impact and greater comfort for the individual concerned. Moreover, this medium enables the stimulation of metabolic and neuromuscular systems, followed by their corresponding physiological adaptations allowing both to maintain and improve athletic performance. Hydrotherapy can also play a beneficial role in an athlete's recovery, helping to prevent as well as treat muscle damage and soreness following exercise.

Roundtable Discussion

Aquatic Cross Training for Athletes: Part I

G. Gregory Haff, PhD,
CSCS*D, FNSCA
Column Editor

SUMMARY

THE CURRENT ROUNDTABLE IS THE FIRST PART OF A 2-PART SERIES THAT IS DESIGNED TO EXAMINE THE USE OF AQUATIC EXERCISE TRAINING, SUCH AS

athletes. In particular, deep-water running has received a lot of attention as it offers a unique training stimulus that has the ability to maintain aerobic performance as well as decreasing the stress of the training environment (1). Interestingly, the use of deep-water running appears to supply an effective cardiovascular training stimulus with both healthy and injured individuals (1). When individuals are restricted from land-based exercise, the use of aquatic-based cross-training with modalities such as deep-water running appears to offer an alternative exercise method that has the ability to translate to running performance.

The current roundtable is designed to

Although these athletes have reported success with aquatic cross-training, there is little scientific evidence to support these athletes' claims for the majority of these sports. In the 1990s, there was a flurry of scientific research investigating the viability of deep-water running/jogging as a cross-training modality (1–3,6,11,12). In general, the majority of these studies suggest that adding deep-water running to an athlete's training regimen has the potential to increase fitness and ultimately improve performance.

Huff: Several research studies suggest that aquatic exercise may be valuable as a mode of cross-training for certain

Roundtable Discussion

Aquatic Cross Training for Athletes: Part II

G. Gregory Haff, PhD,
CSCS*D, FNSCA
Column Editor

SUMMARY

THE CURRENT ROUNDTABLE IS THE SECOND PART OF A TWO

cross training in athletic activities that lead to frequent injury from overtraining, such as distance run training. During the later stages of training, we often had the athletes train in water for 3 of 6 days training, with the seventh for rest. In general, 2 or 3 days per week of cross training will see a significant positive effect. Typically we trained athletes at the same intensity that they would use for their normal training level. Often, this was achieved through Borg scale techniques, as in-water heart rate measurement is both difficult and may be inconsistent with land rates. We have found training durations of 50 to 90 minutes to be sufficient.

system is also suggested due to the recruitment of smaller muscle groups (13) with reports of more muscle fatigue in the arms, shoulders, hips and legs during deep water run training.

Huff: Discussing frequency, duration and intensity of aquatic cross training can be challenging. The recommendations would have to be specific to the sport, the athlete and the program. The recommendations would also be based on the purpose of using aquatic cross training and the phase in the training cycle. Aquatic cross training could be implemented:

- As part of a rehab protocol following an injury. The frequency, duration

1. Evidenze scientifiche
2. Mantenimento fitness aerobica
3. Incremento della resistenza
4. Incremento forza
5. Tipologia di attività
6. Frequenza, durata ed intensità delle sessioni
7. Differenza nel determinare l'intensità tra ambiente acquatico e terrestre
8. Ambiente acquatico più favorevole ed efficace
9. Principali benefici
10. Integrazione del training acquatico in un programma di allenamento

Effect of Resistive Exercise on Muscle Damage in Water and on Land

Patrícia D. Pantoja,[1] Cristine L. Alberton,[1] Carmen Pilla,[2] Alecsandra P. Vendrusculo,[1] and Luiz F. M. Kruel[1]
[1]*Laboratory of Exercise Research, Faculty of Physical Education, Federal University of Rio Grande do Sul, Porto Alegre, Brazil; and* [2]*Laboratory of Clinical Pathology, Porto Alegre Clinical Hospital, Porto Alegre, Brazil*

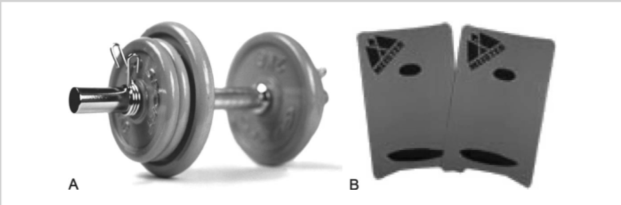

Figure 1. Devices of the 2 exercises: dumbbell used on land (A) and resistive equipment used in water (B).

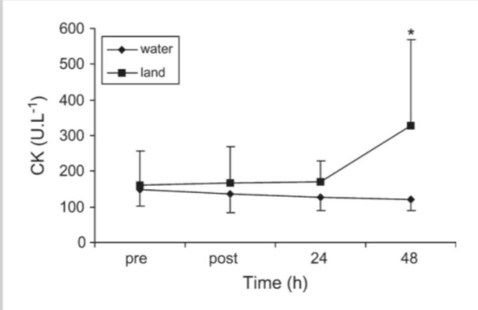

Figure 2. Mean plasma creatine kinase (CK) levels in water and on land, before exercise (pre), immediately after exercise (post), and 24 and 48 hours after exercise.

PLOS | ONE

RESEARCH ARTICLE

Quantifying kinematic differences between land and water during squats, split squats, and single-leg squats in a healthy population

Anna C. Severin[1‡*], Brendan J. Burkett[1©], Mark R. McKean[1©], Aaron N. Wiegand[2©], Mark G. L. Sayers[1©]

1 School of Health and Sports Sciences, University of the Sunshine Coast, Sippy Downs, Queensland, Australia, 2 School of Science and Engineering, University of the Sunshine Coast, Sippy Downs, Queensland, Australia

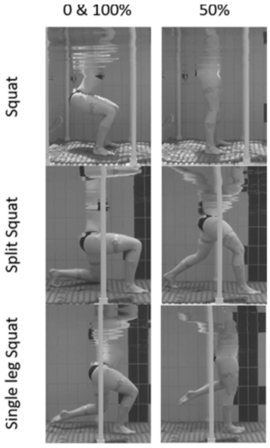

Fig 1. Exercise protocol. Participant performing the three exercises during immersion to highlight the top (0 and 100%) and bottom (50%) position of the three exercises.

J Rehabil Med 2010; 42: 664–669

ORIGINAL REPORT

LOADING FORCES IN SHALLOW WATER RUNNING AT TWO LEVELS OF IMMERSION

Alessandro Haupenthal, MSc, Caroline Ruschel, MSc, Marcel Hubert, MSc, Heiliane de Brito Fontana, BSc and Helio Roesler, PhD

From the Aquatic Biomechanics Research Laboratory, Department of Health and Sports Sciences, Santa Catarina State University, Florianópolis, Brazil

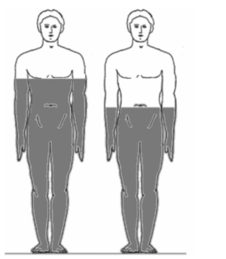

Fig. 1. Immersion levels used in the study: chest level (left) and hip level (right).

RESULTS

Fig. 3 shows the average curves for the vertical (Fy) and the anteroposterior (Fx) components of the ground reaction force during shallow water running at the chest and hip levels of immersion.

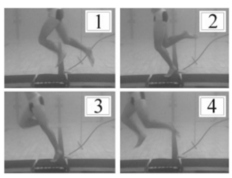

Fig. 2. Example of a valid trial: (1) approach, (2) foot contact, (3) propulsion, and (4) flight phase.

SPORTS BIOMECHANICS, 2016
http://dx.doi.org/10.1080/14763141.2016.1162840
Routledge Taylor & Francis Group

Mechanical parameters and flight phase characteristics in aquatic plyometric jumping

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[a]Biomechanics Laboratory, Health, Physical Education and Recreation Department, Utah State University, Logan, UT, USA; [b]Sport Performance Research Institute, Auckland University of Technology, Auckland, New Zealand

ABSTRACT
Plyometric jumping is a commonly prescribed method of training focused on the development of reactive strength and high-velocity concentric power. Literature suggests that aquatic plyometric training may be a low-impact, effective supplement to land-based training. The purpose of the present study was to quantify acute, biomechanical characteristics of the take-off and flight phase for plyometric movements performed in the water. Kinetic force platform data from 12 young, male adults were collected for counter-movement jumps performed on land and in water at two different immersion depths. The specificity of jumps between environmental conditions was assessed using kinetic measures, temporal characteristics, and an assessment of the statistical relationship between take-off velocity and time in the air. Greater peak mechanical power was observed for jumps performed in the water, and was influenced by immersion depth. Additionally, the data suggest that, in the water, the statistical relationship between take-off velocity and time in air is quadratic. Results highlight the potential application of aquatic plyometric training as a cross-training tool for improving mechanical power and suggest that water immersion depth and fluid drag play key roles in the specificity of the take-off phase for jumping movements performed in the water.

ARTICLE HISTORY
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Accepted 18 November 2015

KEYWORDS
Water; jump; stretch-shortening; kinetics; mechanics

Impact Forces of Plyometric Exercises Performed on Land and in Water

Orna A. Donoghue, PhD†* Hirofumi Shimojo, MSc‡ and Hideki Takagi, PhD‡

Figure 1. Force plate embedded in a platform on the floor of the swimming pool.

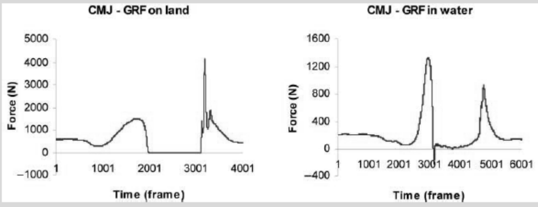

Figure 2. Force-time trace when performing a countermovement jump on land and in water.

Aquatic Plyometric Training Increases Vertical Jump in Female Volleyball Players

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MEDICINE & SCIENCE IN SPORTS & EXERCISE®

TABLE 2. Vertical jump measurements at baseline and after 2, 4, and 6 wk

	APT (*N* = 10)	CON (*N* = 9)
VJ at baseline (cm)	33.4 ± 4.7	31.9 ± 5.3
VJ after 2 wk (cm)	33.1 ± 4.7	32.1 ± 5.4
VJ after 4 wk (cm)	34.4 ± 5.6*	33.5 ± 5.0*
VJ after 6 wk (cm)	37.1 ± 4.5*†	33.2 ± 4.7*

* Significantly greater than VJ at baseline ($P < 0.05$). † Significantly greater than VJ after 4 wk ($P < 0.05$). All data are mean ± SD. VJ, vertical jump height.

In summary, the present study indicates that APT can produce significant increases in VJ and, to some extent, isokinetic peak torque in young female volleyball players. In addition, because athletes can perform high-intensity plyometric exercises in water, it is proposed that APT could provide similar benefits as land-based plyometrics, but with lower risk of muscle soreness and/or overtraining.

The effect of aquatic and land plyometric training on strength, sprint, and balance in young basketball players

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hoc testing and independent-sample *t*-test. The results showed there were not any significant differences between the APT and LPT groups in any of the variables tested (P>0.05). Significant increases were observed in posttraining both APT and LPT groups in 36.5-m and 60-m sprint times record compare to pretraining (P<0.05). There was a significant difference in relative improvement between the APT and CON in 36.5-m, 60-m, and one repetition maximum leg press (P<0.05). We conclude that plyometric training in water can be an effective technique to improve sprint and strength in young athletes. **Key words**: WATER,

Comparison of aquatic- and land-based plyometric training on power, speed and agility in adolescent rugby union players

David Leslie Fabricius Copyright © 2011 Stellenbosch University

Table 2.1 The different types of lower-body plyometric drills (Potash & Chu, 2008)

Type of Jump	Rationale
Jumps in Place	These drills involve jumping and landing in the same spot. Jumps in place emphasize the vertical component of jumping. They are usually performed repeatedly without rest between jumps
Standing Jumps	Standing jumps emphasize either the horizontal or vertical components. These drills are at maximal effort with sufficient recovery between repetitions.
Multiple hops and jumps	These drills involve repeated movements and may be viewed as a combination of jumps in place and standing jumps.
Bounds	These drills use exaggerated movements with greater horizontal speed than other drills.
Box Drills	By using a box these drills increase the intensity of multiple hops and jumps. The box may be used to be jumped on to, or jumped off from.
Depth Jumps	Using the athlete's gravity, depth jumps increase exercise intensity. The athlete assumes a position on a box, steps off, lands, and immediately jumps vertically, horizontally, or to another box.

Table2.2 Lower-body plyometric warm-up drills (Potash & Chu, 2008)

Type of Jump	Explanation
Marching	Mimics running movements Improves proper lower body movements for running.
Jogging	Prepares for impact and high-intensity plyometric drills. E.g. toe jogging, straight-leg jogging, butt-kicking.
Skipping	Skipping is an exaggerated form of reciprocal upper and lower extremity movements.
Footwork	Footwork drills that target change of direction.
Lunging	This drill is based upon the forward lunge, and may also be multi-directional.

The aquatic-based plyometric intervention group

The land-based plyometric intervention group

International Journal of Aquatic Research and Education, 2009, 3, 398-405

Maximum and Resting Heart Rate in Treadmill and Deep-Water Running in Male International Volleyball Players

Antonio Cuesta-Vargas, Jeronimo Carmelo Garcia-Romero, and Raija Kuisma

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Muscle activity during different styles of deep water running and comparison to treadmill running at matched stride frequency

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ABSTRACT

The purpose of this study was to compare muscle activity during deep water running (DWR) and treadmill running on dry land (TMR) as well as to investigate effect of stride frequency (SF) on muscle activity while using different styles of DWR (high-knee and cross-country styles, DWR-HK and DWR-CC, respectively). Eight subjects participated in this study. The baseline condition consisted of TMR at the preferred stride frequency (PSF). The remaining conditions consisted of DWR-HK and DWR-CC at PSF, PSF−15%, and PSF+15%. Muscle activity was recorded from the rectus femoris, biceps femoris, tibialis anterior, and gastrocnemius. Rectus femoris and biceps femoris muscle activity during DWR-CC-PSF were significantly greater than that of TMR-PSF ($P < 0.05$). However, rectus femoris muscle activity during DWR-HK-PSF was significantly lower than that of TMR-PSF ($P < 0.05$). Gastrocnemius muscle activity during both DWR-HK-PSF and DWR-CC-PSF were significantly lower than that of TMR-PSF ($P < 0.05$). Furthermore, muscle activity from all tested muscles during DWR-HK and DWR-CC increased with increasing SF ($P < 0.05$). These observations indicated that muscle activity is influenced not only by running in the water but also by the style of DWR (DWR-HK, DWR-CC) used.

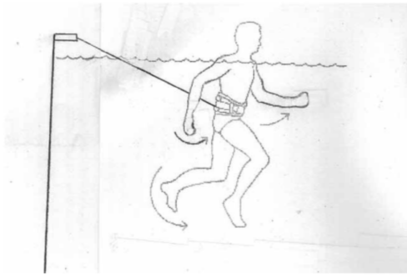

Figure 1 — Symbolized drawing of deep-water running.

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Effect of aquatic training with and without weight on selected physiological variables among volleyball players

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Abstract

The purpose of this study is to enhance sports performance: the objective is to analyse the effect of aquatic training with and without weight on selected physiological variables among volleyball players. To achieve this 60 physically active and interested undergraduate engineering volleyball players are selected as subjects and their age ranged between 18 and 20 years. The subjects are categorized into three groups randomly viz. Control group (CG), Aquatic training with weight group (ATWG), Aquatic training without weight group (ATWOG) and each group comprises of 20 subjects. Control group was not exposed to any training. Both experimental groups underwent their respective experimental treatment for 12 weeks, 3 days per week and a session on each day. Breath holding time, resting pulse rate were taken as variables for this study. The collected data was analyzed using analysis of covariance (ANCOVA) and Scheffee's post hoc test. The result reveals significant differences in all the selected physiological variables among ATWG and ATWOG pointing towards the use of aquatic training for performance improvement.

"Biomechanical Comparison of Countermovement Jumps Performed on Land and in Water: Age Effects"
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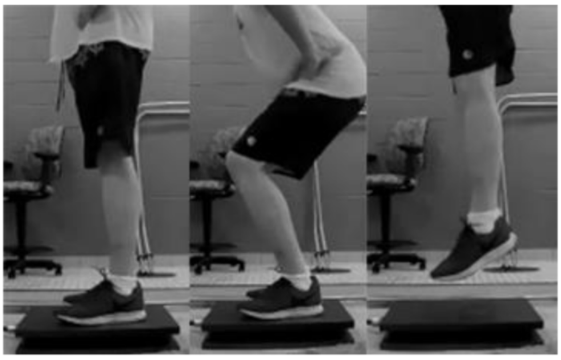

Figure 1. Still images of a jump performed by an older adult on land.

Figure 2. Still images of a jump performed by an older adult in chest-deep water.

REVIEW ARTICLE

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Physiological Response to Water Immersion

A Method for Sport Recovery?

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Effect of aqua exercise on recovery of lower limb muscles after downhill running

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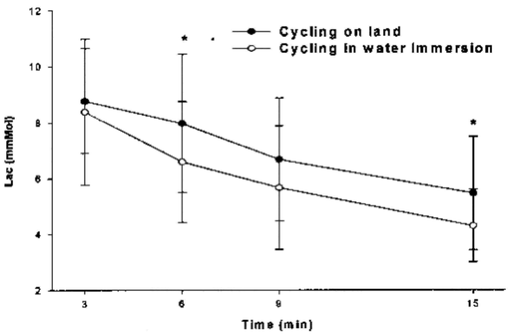
Available online: 18 Feb 2007



Dopo 6' al treadmill al 10% al di sopra della LT, esercizio di 15' di recupero attivo al 65% della APMHR

Rimozione del LA più rapida in acqua al 6° e 15° minuto

Di Masi , 2007, J Sports Sci and Med 6: 188-192

Riatletizzazione in acqua

- Attività complementari, alternative o sinergiche all'interno di un programma di riatletizzazione dell'atleta per il ritorno allo sport ed alla performance
- Anche se in situazione aspecifica, queste attività possono sviluppare capacità specifiche (cardiovascolari, metaboliche, fisiche, tecniche) e incrementare capacità funzionali in contesti atraumatici
- Possono inoltre implemetare il carico di allenamento e gli stimoli per l'atleta quando ciò non sia possibile (o sia potenzialmente traumatico) nell'ambiente e nella condizione specifica
- Possono infine integrare il lavoro finale di riatletizzazione dell'atleta con lavori specifici di recupero, di rigenerazione, di allungamento

Grazie!