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SYSTEMATIC REVIEW

Aquaticity: A discussion of the term and of how it applies to humans



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Summary The relationship between humans and water and the effects on aspects related to human performance has never been studied scientifically. The aim of the current systematic review is to attempt to define the term “aquaticity”, present the factors that describe it and reveal the form in which it presents itself in today’s society, in order to become a distinct scientific field of study. A systematic review of the literature has been conducted using anecdotal reports from the internet and forums as well as scientific articles and books from databases on issues related to aquatic sports.

To the best of our knowledge there are no scientific articles dealing with human’s aquaticity. In the current systematic review, four factors have been recognized that are closely related to human aquaticity. Those are related to physical condition in the water, to apnea and ability to immerse, to mental health and to parameters related to body composition.

According to our findings, “Aquaticity is the capacity of a terrestrial mammalian organism to function and habitually in the aquatic environment. The level of aquaticity depends on mental and physical characteristics and can be improved by frequent exposure to the water element”. The ideal state of aquaticity is achieved through the activation of the diving reflex, when the human body is totally immersed in water. The development of knowledge regarding the aquatic environment leads humans to an improved state of aquaticity.

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Introduction

The aim of the current article is to attempt to discuss and define the term *aquaticity*, as it applies to humans, present the factors that characterize it and reveal the form in which it presents itself in today's society, in order to become a distinct scientific field of study that would allow its assessment as another parameter of human performance. One of the main difficulties of the subject is the term itself. To our knowledge, aquaticity, when used, describes the 'level' of being aquatic (Torre, 2014). While missing in formal dictionaries it is a term frequently used in many biological disciplines and variable contexts. For example in ecology, aquaticity levels could range from 1 (truly aquatic species) to 8 (brackish water or salty marsh species) – but the meaning of the term there is restricted in the evaluation of 'affinity' of an organism to water (Birk, 2009). In sports coaching, trainers empirically evaluate children's aquaticity (for example when selecting 'talented' children for water sports) as ability to perform inside or underwater (Knight, 2014). In rehabilitation, physiotherapists evaluate how 'comfortable' a patient may be in water. While in diving, aquaticity refers strictly to a diver's ability for optimal underwater performance (a culmination of efficacious and thus safe underwater movement) (Tutorov, 2008; Boetticher, 2010; Winram, 2014).

Based on the literature, popular sports culture and our interactions with the diving community it became clear that while aquaticity is indeed a term used among divers and swimmers, to describe how 'comfortable', 'efficient', or 'successful' an athlete may be during water immersion etc, aquaticity has not been clearly defined in the scientific literature nor is it used to scientifically describe 'ability in water'. This poses a problem as often coaches, trainers and athletes refer to *levels* of aquaticity expressed through their empirical observations or expressions of personal experiences (Havriluk, 2014). Moreover, as water activities are used in special needs education and rehabilitation/therapy settings, it became evident that there is a need to address the term and place it in a scientific context – that is the purpose of this article.

The benefit will be that a basis will be set for describing 'ability in water' and that will allow for devising a test to objectively evaluate it, and thus support the needs of various populations engaged in water activities. Indeed an aquaticity test has been developed and validated in healthy individuals by our group (Varveri et al., 2014).

Aquaticity does not describe a 'vague' relationship between humans and water. We propose that it is a performance attribute that can be evaluated and improved upon with various interventions. Our aim is to clarify and define the term as "a water performance" attribute the capacity of a terrestrial mammalian organism to function and habituate in the aquatic environment. If such a goal would be achieved then not only communication among sport scientists, coaches, physical therapists, and water safety educators will be greatly improved – but also communication among other disciplines such as biologists, physiologists and anthropologists.

Methods

In our effort to investigate the term aquaticity and its characteristics, we have conducted a search using electronic databases, scientific articles and books on aquatic sports.

A search in the electronic databases such the Google, Yahoo, Answers.com, Ask.com and Bing reveal that the term aquaticity in Greek – (υδροβιότητα) appears mainly in websites that related to free-diving and scuba diving, as well as websites that contain information about underwater fishing (spear fishing). In addition a search of the equivalent English term was conducted (i.e. aquaticity), however, we came across various statements made by free diving athletes, who present their own perspective on aquaticity, based on their personal experiences and long-term participation in water sports. Scientific databases such as the PubMed, Scopus and ScienceDirect were also used for additional information on the subject of aquaticity in humans. Furthermore, our methodology extended to the review of books, scientific articles and studies on various sports that take place on, in and under the surface of water. The following key terms were used during our extensive search: swimming abilities, aquatics, synchronized swimming advanced water skills, water confidence, mindful swimming, aquatic brain, talent swimmers, factors influencing success in swimming performance, apnea, free diving, diving response (depth, temperature etc), special adaptations (water vision, navigation etc.) of Ama Japanese divers, Moken (sea people), body shape & composition, water dance, benefits of water exercise, aqua-phobia, fluidity, sailing, surfing, human amphibious.

Results and discussion

Results from the most popular internet search engine with the term 'aquaticity' resulted in about 2735 'hits' (google) mostly in diving/sports pages with aquaticity being referred to as 'ability or comfort in water'. More restricted search among available scholarly work resulted in 20 results (Google scholar). In Greek the equivalent term is "υδροβιότητα" which gives over 971 hits in Greek, again with relation to diving and water activities. A related term is hydrobiosis (υδροβίωση) which has a clear biological meaning (= ability of an organism to live/thrive underwater). The term, "hydrobiosis", appears in ~4700 hits in general search and ~446 hits in academic search (Google scholar). No scientific articles have been found under the subject of Aquaticity or similar terminology when PubMed or other scientific data bases were used.

Definition of aquaticity: why "introduce" a new term?

Aquaticity offers the characteristics that mammals need in order to function within water. The meaning of the term *aquaticity* is closely related to life itself, given the fact that human beings spend the first 9 months of their lives within the amniotic sac, surrounded by the amniotic fluid.

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