

Impact of Aquathlon Training on Different Age Groups in Physical and Functional Fitness

INPLASY202610001

doi: 10.37766/inplasy2026.1.0001

Received: 1 January 2026

Published: 1 January 2026

Gomes, R.

Corresponding author:

Rui Gomes

ruicinho@gmail.com

Author Affiliation:

Instituto Superior de Lisboa e Vale do Tejo, using swimming pools at the Reboleira sports complex and suitable locations for running in Amadora.

ADMINISTRATIVE INFORMATION

Support - The study will receive support and access to facilities from the sports complexes and swimming pools used.

Review Stage at time of this submission - The review has not yet started.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY202610001

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 1 January 2026 and was last updated on 1 January 2026.

INTRODUCTION

Review question / Objective The study aims to implement a structured aquathlon training protocol, adjusting training loads and volumes according to the individual characteristics of participants and their respective age groups. The intervention will consist of individualized and group training sessions, including running, swimming, general strength, and mobility exercises.

Pre- and post-intervention assessments will be conducted, allowing comparison of the same participants' performance in swimming and running, as well as recording changes in endurance, speed, strength, and functional capacity.

The study intends to investigate the benefits of integrated practice across the different aquathlon disciplines, as well as to evaluate the applicability of the program in promoting physical activity and

preventing conditions such as sedentary behavior, social exclusion, sarcopenia, and obesity. Additionally, it aims to develop specific guidelines for different age groups, enabling the future implementation of the protocol in swimming pools and sports complexes.

Rationale Triathlon is a sport that combines swimming, cycling, and running, requiring high physical and mental capacities and promoting the development of endurance, strength, speed, and overall physical fitness. Since the first organized triathlon in California in 1974, the sport has shown significant growth worldwide. In Portugal, the first triathlon was held in 1984, in Peniche, marking the beginning of its national implementation.

From the development of triathlon emerged aquathlon, a sport that combines only swimming and running, making it more accessible and practical, especially for younger populations and training contexts. Aquathlon later became an independent competitive sport, with world

championships recognized by World Triathlon. In Portugal, organized aquathlon practice began in the 2000s, also in Peniche.

One of the main characteristics of aquathlon is its ease of practice, as it does not require complex equipment or specific infrastructure like cycling, allowing easier implementation in swimming pools and sports complexes. Moreover, distances are adapted to different age groups and competitive levels, allowing gradual progression for participants. In youth categories, Benjamins (2015–2017) swim 50 m and run 400 m; Infants (2013–2014), 100 m swim and 800 m run; Initiates (2011–2012), 170 m swim and 1000 m run; and Juveniles (2009–2010), 220 m swim and 2000 m run.

Despite the growth of aquathlon, there are still gaps in scientific evidence regarding the effects of training in different age groups and fitness parameters. Additionally, there are no standardized protocols for adjusting training loads and volumes, nor guidelines for safe implementation in swimming pools and sports complexes. Therefore, this study aims to fill these gaps and develop structured aquathlon training programs that are safe, effective, and adapted to different age groups.

Condition being studied Aquathlon is a sport modality derived from triathlon that combines swimming and running and is practiced by different age groups. This modality requires high physical capacities, including endurance, speed, and strength, as well as overall physical fitness and functional capacity. In Portugal, aquathlon participants are mostly professional or amateur athletes competing under the Portuguese Triathlon Federation. Despite its growing popularity nationally and internationally, few studies systematically evaluate the effects of aquathlon training across different age groups, particularly children, adolescents, adults, and older adults. This study aims to analyze how structured aquathlon practice influences these physical capacities, providing relevant information for the safe and effective prescription of the modality in different populations.

METHODS

Search strategy The search strategy will include relevant electronic databases in sports and health sciences, such as PubMed, Scopus, Web of Science, SPORTDiscus, SciELO, and Google Scholar. Search terms will be combined using Boolean operators (AND, OR) and truncation (*) to capture word variations and expressions related to

the sport, training, and physical fitness parameters.

Search phrases will include (aquathlon OR triathlon) AND (training OR exercise); (aquathlon OR triathlon) AND (swimming AND running); (aquathlon OR triathlon) AND (physical fitness OR endurance OR strength OR speed); (aquathlon OR triathlon) AND (children OR adolescents OR adults OR older adults) AND training*.

Participant or population The study population will include participants of both sexes, across different age groups, namely children, adolescents, adults, and older adults, who practice swimming, water aerobics, or other activities performed in a pool or sports complex. Only individuals without competitive experience in the modality will be included, and participation in the program will be voluntary.

Intervention The intervention consists of the implementation of a structured aquathlon training protocol, encompassing swimming, running, transition techniques, strength training, mobility exercises, and stretching. Sessions will be conducted individually or in groups, with a frequency of 2 to 3 times per week, over a 12-week period.

At the beginning of the program, an initial assessment will be performed, including anthropometric measurements, heart rate, systolic and diastolic blood pressure, as well as endurance and speed tests in swimming and running, estimated muscle strength via RM, and functional capacity assessed through motor dexterity.

Training intensity and load will be individually adjusted according to each participant's fitness level, with gradual progression throughout the program. Training sessions will follow principles similar to competitive training, with appropriate reductions in loads and volumes. At the end of the 12 weeks, potential significant changes compared to the initial phase will be evaluated using the same measurement instruments.

Objectives

General: To develop and implement a structured aquathlon program in swimming pools and sports complexes, promoting correct and motivating practice, improving aerobic endurance, speed, muscle strength, and functional capacity of participants across different age groups.

Specific:

Develop swimming technique in all four strokes, with emphasis on freestyle.

Improve running technique, emphasizing correct body posture and coordinated movement of the upper and lower limbs.

Comparator No specific comparator will be applied in this study. Assessments will compare pre- and post-intervention test results within the same participants, allowing the analysis of the effect of the aquathlon training protocol on endurance, speed, strength, functional capacity, and technical performance in swimming and running.

Study designs to be included Experimental pre- and post-intervention studies with tests adjusted to the participant's level will be included, allowing the assessment of the effects of aquathlon training on performance improvement in swimming and running, as well as evaluating enhancements in physical components: endurance, strength, speed, and functional capacity.

Eligibility criteria The study will include participants of both sexes across different age groups, including children, adolescents, adults, and older adults, who practice swimming, water aerobics, or other activities conducted in pools or sports complexes where the protocol will take place. Only individuals without high-level competitive experience in aquathlon, who voluntarily consent to participate and commit to completing the full 12-week program, will be considered. Participants with medical contraindications for swimming and running that cannot be adapted; those who do not voluntarily consent to participate; children without a consent form signed by their legal guardians; and participants who do not complete at least 70% of the scheduled training sessions will be excluded from the study.

Information sources The search will be conducted in relevant electronic databases in sports and health sciences, including PubMed, Scopus, Web of Science, SPORTDiscus, SciELO, and Google Scholar. Clinical trial registries, such as ClinicalTrials.gov, will also be consulted to identify ongoing or unpublished studies. To minimize publication bias, grey literature will be considered, including theses, dissertations, technical reports, and conference proceedings. If necessary, study authors may be contacted to obtain additional or unpublished data.

Main outcome(s) The main outcomes include improvements in physical capacities, namely aerobic endurance, speed, muscular strength, and functional capacity, as well as technical and performance outcomes in swimming and running, assessed after the aquathlon training intervention.

Additional outcome(s) Additional outcomes include adherence to the training program, assessed through attendance and session participation; participants' motivation and satisfaction with the intervention protocol; changes in general health parameters, such as heart rate and perceived exertion; as well as the progression of motor skills related to overall functional capacity and the development of sport-specific technical skills in swimming and running.

Data management All records retrieved from the electronic database searches will be imported into the reference management software Mendeley. Duplicate records will be identified and removed using both automatic and manual functions. Titles, abstracts, and full texts of potentially eligible studies will be screened and organized within Mendeley. Data extracted from the included studies will be recorded using standardized data extraction forms and stored in secure electronic files, with access restricted to the review authors to ensure data integrity and confidentiality.

Quality assessment / Risk of bias analysis The methodological quality and risk of bias of the included studies will be assessed using the ROBINS-I tool, appropriate for pre-post intervention and non-randomized studies. The assessment will consider potential sources of bias related to participant selection, study execution, outcome detection, attrition, and reporting. The evaluation will be conducted by the student, with verification and supervision by the internship supervisor and the program coordinator, ensuring discussion of any discrepancies and maintaining the reliability and rigor of the results.

Strategy of data synthesis Participant data will be organized in Excel tables, including information such as weight, height, BMI, waist and hip measurements, as well as test times recorded before and after the intervention. Graphs and visual representations will be produced to allow a qualitative interpretation of improvements in different evaluated parameters, such as endurance, speed, strength, functional capacity, and performance in swimming and running. Additionally, quantitative analysis will be conducted using Jamovi, enabling a rigorous comparison of pre- and post-intervention results,

reducing data deviations and presenting the outcomes clearly and concisely.

Subgroup analysis A subgroup analysis will be conducted to assess whether the effects of the aquathlon training protocol vary according to participants' age groups (children, adolescents, adults, and older adults) and baseline physical fitness levels. This analysis will help identify differences in training responses among groups, supporting future adjustments to the program and the development of specific recommendations tailored to each age group or physical profile.

Sensitivity analysis A sensitivity analysis will be performed to assess the robustness of the study results in relation to variations in adherence to the training protocol, data quality, and potential confounding factors. This analysis will determine whether the observed results remain consistent when excluding participants with less than 70% adherence to the planned sessions, or when considering only participants with complete data. This approach will help ensure that the study conclusions are not influenced by inconsistencies or gaps in the data and will allow for an evaluation of the reliability of the effect estimates of the aquathlon training protocol.

Language restriction No language restrictions will be applied in the selection of studies or consulted literature. Relevant articles, theses, reports, and other materials will be included regardless of language, in order to.

Country(ies) involved Portugal.

Other relevant information This study is part of the principal investigator's Master's thesis in Sports and Health, under the supervision of the academic advisor and program coordinator. The protocol will be implemented in licensed swimming pools and sports complexes, ensuring adequate infrastructure and safety throughout all sessions. The intervention consists of structured aquathlon training sessions, including swimming, running, strength training, mobility, stretching, and transition technique practice, performed individually or in groups, with a frequency of 2 to 3 times per week over 12 weeks.

Assessments will include tests of endurance, speed, strength, functional capacity, and technical performance in swimming and running, as well as anthropometric measurements, such as weight, height, BMI, and waist and hip circumference. All sessions will be supervised to ensure proper technique execution and prevent injuries. Data will

be organized in Excel tables and analyzed qualitatively through graphs and quantitatively using Jamovi software.

The study will strictly follow ethical standards, with informed consent obtained from participants and responsibility forms signed for minors. The results are expected to provide practical guidelines for the future implementation of aquathlon training programs in recreational, educational, or sports training contexts.

Keywords Motor literacy; running and swimming biomechanics; sport inclusion.

Dissemination plans The results will be published in scientific journals and presented at scientific conferences, and can also be used to develop practical guidelines for the future implementation of aquathlon programs.

Contributions of each author

Author 1 - Rui Gomes - Rui Gomes conceived the study, wrote the protocol, designed the intervention, performed data collection and analysis and will be responsible for the final writing of the manuscript.

Email: ruicinho@gmail.com