Aquatic-Based Tabata training: a training system to improve physical fitness of athletes in situational sports

Lalu Moh Yudha Isnaini1ABCDE, Edi Setiawan2ABCD, Ruslan Abdul Gani3ACD, Luthfie Lufthansa4DE, Novri Gazali5SCD, M.E. Winarno6ACD

1Universitas Nahdlatul Ulama Nusa Tenggara Barat, Indonesia
2Universitas Suryakancana, Indonesia
3Universitas Singaperbangsa Karawang, Indonesia
4IKIP Budi Utomo, Indonesia
5Universitas Islam Riau, Indonesia
6Universitas Negeri Malang, Indonesia

Authors’ Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript preparation; E – Funds Collection

DOI: https://doi.org/10.58962/HSR.2023.9.3.61-73

Corresponding Author: Lalu Moh Yudha Isnaini, alumohyudhaisnaini@gmail.com, https://orcid.org/0000-0003-0487-3549, Universitas Nahdlatul Ulama Nusa Tenggara Barat, Indonesia

How to Cite

Abstract

Purpose: This study aims to investigate the effect of aquatic-based Tabata training on increasing the physical fitness level of athletes in situational sports through a mixed study.

Material and methods: This study adopted a quantitative and qualitative (mixed) approach. Research involved participants who were athletes in situational sports, namely martial arts (n=20) football (n=20). Situational sports are sports with a changing situation during competitive activity. These include sports games and martial arts. Participants were allocated into two groups, namely an experimental group that received an aquatic-based Tabata training program and a control group that carried out normal training. Quantitative instruments for measuring physical fitness was leg dynamometer test, squat jumps, 10 meter running tests, shuttle runs, sit and reach and multi-stage. Meanwhile qualitative instrument involved in-depth interviews for 30 minutes. Quantitative statistical analysis used IBM SPSS to obtain normality, descriptive statistics. Meanwhile, the Independent samples t-test used to test differences in physical fitness values between the before and after of experiment. Paired sample t-test serves to test whether there is an effect of the experimental and control groups on the level of physical fitness. Qualitative statistical analysis through thematic, namely coded and categorized into three themes.

Results: The first finding in the quantitative study showed that there was no difference in the physical fitness of the experimental and control group athletes before the experiment (p>0.05). The second finding that aquatic-based Tabata training had a significant effect on increasing physical fitness (p<0.05), but there was no increase in physical fitness in the control group (p>0.05). The third finding is that there are differences in the physical fitness of the experimental and control group athletes after getting the experiment (p<0.05). Meanwhile qualitative result shows that the athletes agreed that the aquatic-based Tabata training program was easy, fun and efficient to use and saves time. In addition, they also assumed that this training had a big impact in improving physical fitness, but this training also has challenges, namely it could not be applied to pre-teens athletes and has the risk to cause injury if the athletes were not carried out an optimal warming up and not serious in carrying out the training program.

Conclusions: This study concluded that aquatic-based Tabata training was proven to be one of the effective training systems to improve the physical fitness of athletes in situational sports.

Keywords: aquatic-based tabata training, situational sports, physical fitness, mixed method
Анотація
Лалу Мох Юдха Існаїні, Еді Сетіаван, Руслан Абдул Гані, Луфі Люфтанзаз, Новрі Газалі, М. Е. Вінано. Табата-тренування у воді: система тренувань для покращення фізичної підготовки спортсменів у ситуаційних видах спорту
Мета: це дослідження має на меті дослідити вплив тренувань Табата на основі водних видів спорту на підвищення рівня фізичної підготовки спортсменів у ситуаційних видах спорту за допомогою змішаного дослідження.
Матеріал і методи: У цьому дослідженні застосовано кількісний та якісний (змішаний) підхід. У дослідженні брали участь учасники, які займались ситуаційними видами спорту, а саме бойовими мистецтвами (n=20) і футболом (n=20). Ситуаційні види спорту - це види спорту, в яких ситуація змінюється під час змагальної діяльності. До них відносяться спортивні ігри та бойові мистецтва. Учасники були розподілені на дві групи, а саме експериментальну групу, яка проходила тренувальну програму Табата навчання на основі водних видів спорту, і контрольну групу, яка проводила звичайні тренування. Кількісними інструментами для вимірювання фізичної підготовленості були тест на динамометрі, стрибки з присідань, тесты з бігу на 10 метрів, човниковий біг, сидячі і вставаючі та наступати.
Висновки. У цьому дослідженні було зроблено висновок, що тренування Табата на основі водних видів спорту, включаючи водні види спорту, сідячі і вставаючі та наступати, мають значний вплив на покращення фізичної підготовленості. Якісний статистичний аналіз за тематикою, а саме закодований і розділений на три теми.
Результати: Перші результати кількісного дослідження показали відсутність різниці у фізичній підготовленості спортсменів експериментальної та контрольної груп до початку експерименту (p>0,05). Другий висновок полягає в тому, що тренування Табата у водних звичках, які значny звич кількісно фізичні підготовки (p<0,05), але не було підвищення фізичної підготовки у контрольній групі (p>0,05). Третій висновок полягає в тому, що існують відмінності у фізичній підготовленості спортсменів експериментальної та контрольної груп після проходження експерименту (p<0,05). Тим часом якісний результат показує, що спортивники погодилися, що програма тренувань Tabata, заснована на водних заняттях, була легкою, веселою та ефективною у використанні та економічною час. Крім того, вони також припустили, що це тренування було адекватним і таємним використанням волевого енергетичного стану.
Ключові слова: водні заняття табата, ситуативні відомості спорту, фізична підготовка, змішаний метод

Анотация
Лалу Мох Юдха Иснаини, Эди Сетиаван, Руслан Абдул Гани, Луфти Люфтанза, Новри Газали, М. Э. Винарно. Табата-тренировка в воде: система тренировок для улучшения физической подготовленности спортсменов в ситуативных видах спорта
Мета: это исследование направлено на изучение влияния табата-тренировок в водной среде на повышение уровня физической подготовки спортсменов, занимающихся ситуационными видами спорта, посредством смешанного исследования.
Материал и методы: В данном исследовании применялся количественный и качественный (смешанный) подход. В исследовании принимали участие участники, которые занимались ситуационными видами спорта, а именно боевыми искусствами (n=20) и футболом (n=20). Ситуационные виды спорта — это виды спорта с меняющейся обстановкой в ходе соревновательной деятельности. К ним относятся спортивные игры и боевые искусства. Участники были разбиты на две группы, а именно экспериментальную группу, которая проходила водную тренировочную программу табата, и контрольную группу, которая провела обычную тренировку. Количественными инструментами для измерения физической подготовленности были тесты на динамометрию ног, прыжки в присед, бег на 10 метров, чинноый бег, прыжки и сидячие и вставающие на табата. При этом качественный инструмент предполагает проведение глубинных интервью продолжительностью 30 минут. Количественный статистический анализ использовал IBM SPSS для получения нормируемых, описательных статистик. Мальк т-критериев независимых выборок использовался для проверки различий в значениях физической подготовленности до и после эксперимента. Парный выборочный t-критерий служит для проверки наличия влияния экспериментальной и контрольной групп на уровень физической подготовленности. Количественный анализ посредством тематического, а именно закодированного и разделенного на три темы.
Результаты: Первый вывод в количественном исследовании показал, что до эксперимента не было различий в физической подготовленности спортсменов экспериментальной и контрольной групп (p>0,05). Второй вывод заключается в том, что существуют различия в физической подготовленности спортсменов экспериментальной и контрольной групп после попадания в эксперимент (p<0,05). В то же время качественный результат показывает, что спортсмены согласились с тем, что тренировочная программа табата на водной основе была простой, увлекательной и эффективной в использовании и экономила время. Кроме того, они также предположили, что эта тренировка оказало большое влияние на улучшение физической формы, хотя эта тренировка также имеет проблемы, а именно она не может быть применена к спортсменам до подросткового возраста и может привести к травмам, если спортсмены не выполняли оптимальную разминку и несерезно относились к выполнению тренировочной программы.
Выводы: Это исследование показало, что табата-тренировки в водной среде оказались одной из эффективных тренировочных систем для улучшения физической подготовки спортсменов, занимающихся ситуационными видами спорта.
Ключевые слова: водная табата-тренировка, ситуационные виды спорта, физическая подготовка, смешанный
Introduction

In sports, the presence of the COVID-19 pandemic had caused several negative impacts, namely, sports activities must be stopped and suspended for an undetermined time [1, 2, 3], which cause the athletes’ performance decreased drastically [4, 5]. The data showed that the causative factors were unfrequently practice due to social/physical distancing policies [6, 7], lockdown/isolation implemented by governments in all countries [8, 9, 10], including Indonesia. In addition, a recent study reported that there was closure in sports venues and facilities globally [11]. It was recorded that the physical fitness of athletes in situational sports was the first performance that decline during [12] or after the COVID-19 pandemic crisis [13, 14, 15]. According to Kaur, Singh, Arya & Mittal [16], physical fitness definitely experienced a gradual decline, because sports activities or gym exercises were not available or prohibited during the pandemic.

Physical fitness was an important aspect for humans to carry out daily activities [17, 18], whereas athletes can assist in carrying out training activities without experiencing excessive fatigue [19] and support their abilities when competing. The benefits of physical fitness were documented, for example physical fitness can support athletes to show the optimal performance during competition [20] and could be as a predictor of health [21], social and mental level [22]. Athletes with a good physical fitness could have a better strength, agility, speed, endurance and power [23], than athletes with low physical fitness [24]. In addition, the results of previous studies reported that physical fitness was closely related to the technical, tactical and psychological quality of an athlete, while a low physical fitness can cause injury [25]. Based on the importance of physical fitness aspect for an athlete in situational sports, it was necessary to have proper training through aquatic-based Tabata training.

Tabata is a training system that combined high-intensity and interval training [26, 27, 28]. Nowadays, this training became more popular and it was often used by trainers [29]. This training had several movements such as squats, high knees, mountain climbers and planks, which each movement was performed at high intensity for 20 seconds followed with 10 seconds rests before moving on to the next movement [30]. Whereas aquatic-based Tabata training was conducted in water with or without music [31], to increase the burden on the body. The benefits of aquatic-based Tabata training had been well documented, for example it was effective for increasing muscle power in swimming athletes [26], improving cardiorespiratory fitness [32]. Despite the positive benefits provided by Tabata training, there was a study reported that pre-teens with low physical fitness would tend to choose not to continue this training [33]. Therefore, this research was considered important to answer the gaps in Tabata training.

Research on Tabata training was documented internationally [31, 34, 35, 36, 37]. However, there was still limited studies investigating the effects of the aquatic-based Tabata training method to improve physical fitness in athletes in situational sports. In addition, our research attempted to present a novelty from previous studies, namely to analyze the effects of aquatic-based Tabata training through quantitative and qualitative (mixed) research. This research has implications as information or reference for coaches, lecturers and athletes about the importance of using aquatic-based Tabata training to improve physical fitness among athletes in situational sports. Situational sports are sports with a changing situation during competitive activity. These include sports games (for example, football) and martial arts (for example, Pencak Silat). Therefore, our study aims to investigate the effect of aquatic-based Tabata training on increasing the physical fitness level of athletes in situational sports through a mixed study.

Material and methods

This study adopted a mixed method type, which combined quantitative and qualitative study [26]. In addition, the research applied an explanatory sequential design.

Participants

Participants were athletes in situational sports, namely pencak silat and football, from Nahdlatul Ulama University, West Nusa Tenggara (Indonesia). They were recruited randomly, by sending invitations via Whatsapp, then 40 out of 50 athletes were responded. Then they were required to generate a statement of willingness to be involved in this research. The participant recruitment activities were carried out before the research began. 40 participants were allocated into two groups, namely experimental group (n=20) received the aquatic-based Tabata program and the control group (n=20)
did not receive any special program or the athletes did their usual daily training. In order to maintain the participants' identity, the researcher gave the symbol "P". The details about characteristics of participants are presented in Table 1.

### Table 1

The Characteristics of Participants

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Experimental group</th>
<th>Control group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>11(55%)</td>
<td>8(40%)</td>
</tr>
<tr>
<td>Female</td>
<td>9(45%)</td>
<td>12(60%)</td>
</tr>
<tr>
<td>Age (y)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>4(20%)</td>
<td>3(15%)</td>
</tr>
<tr>
<td>20</td>
<td>9(45%)</td>
<td>6(30%)</td>
</tr>
<tr>
<td>21</td>
<td>5(25%)</td>
<td>10(50%)</td>
</tr>
<tr>
<td>22</td>
<td>2(10%)</td>
<td>1(5%)</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>10(50%)</td>
<td>8(40%)</td>
</tr>
<tr>
<td>55</td>
<td>3(15%)</td>
<td>5(25%)</td>
</tr>
<tr>
<td>60</td>
<td>5(25%)</td>
<td>6(30%)</td>
</tr>
<tr>
<td>65</td>
<td>2(10%)</td>
<td>1(5%)</td>
</tr>
<tr>
<td>Height (cm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>155</td>
<td>3(15%)</td>
<td>2(10%)</td>
</tr>
<tr>
<td>160</td>
<td>10(50%)</td>
<td>4(20%)</td>
</tr>
<tr>
<td>165</td>
<td>5(25%)</td>
<td>9(45%)</td>
</tr>
<tr>
<td>170</td>
<td>2(10%)</td>
<td>5(25%)</td>
</tr>
<tr>
<td>Situational sports</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pencak Silat</td>
<td>12(60%)</td>
<td>13(65%)</td>
</tr>
<tr>
<td>Football</td>
<td>8(40%)</td>
<td>7(35%)</td>
</tr>
</tbody>
</table>

### Instruments

#### Quantitative Instruments

Quantitative instruments were used to measure the level of physical fitness of athletes through six tests from EUROFIT that have been validated by the European Council, including:

**Leg dynamometer (kg).** This instrument aims to measure muscle strength in the lower leg using a leg dynamometer [24, 38]. The method was standing on the leg dynamometer, hands was holding the handle, body upright, legs bent at 45 degrees. After the "yes" signal, participants pulled the handles as hard as possible and straightened their knees until they stand straight. The leg muscle strength score can be seen on the leg dynamometer measurement tool. This instrument has a validity level of 0.89 and a reliability of 0.86.

**Squat Jumps (cm).** This instrument aims to measure an athlete's power level by using a squat jump. This test was carried out through two squat jumps and the best value was used for statistical analysis [39, 26]. This instrument was tested prior in this study, which has a validity value of 0.82 and a reliability of 0.78.

**Run test 10 meter (s).** This instrument aims to measure the speed of athletes in running using a 10-meter run test [40]. This test was carried out by standing at the start line and after the whistle sounds the participant runs as fast as possible over a distance of 10 meters to the finish line. The assessment was carried out from the scores based on the shortest running time. This instrument was tested prior this study, and it has a validity value of 0.89 and a reliability of 0.88.

**Shuttle Run: 4×10 meters (s).** This instrument aims to measure the agility of athletes in running using the Shuttle Run: 4×10 meters [41]. This test was carried out by standing behind the starting line or cone A. After the whistle sounded, the participants run as fast as possible with a distance of 10 meters towards and touch cones B. The shuttle run was carried out 4 times. Assessment was carried out based on a score, namely running time. This instrument was tested beforehand in this study, and it has a validity value of 0.77 and a reliability of 0.80.

**Sit and Reach Test (cm).** This instrument aims to measure the body flexibility using the Sit and Reach Test [42]. This test was carried out by sitting on the floor with both legs straight on the sit and reach surface. Slowly the participants bent their bodies with their arms straight against the sit and reach table and tried to flex their bodies and arms forward as far as possible. Assessment was conducted by measuring the farthest distance. This instrument was tested beforehand in this study, and it has a validity value of 0.89 and a reliability of 0.84.

**Multi-stage (ml/kg/min).** This instrument aims to measure the body's VO2max endurance using a Multi-stage Running Test/bleep test [43]. This test was carried out by running continuously with a distance of 20 meters. Participants must reach to the opposite side at the beep sound. Do this running motion repeatedly until the participant can't take it anymore or the participant was no longer able to adjust to the speed that has been set in the audio recording. Assessment was conducted by calculating the number of levels and return that was
obtained then it was converted into V_o2max. This instrument was tested beforehand in this study, and it has a validity value of 0.76 and a reliability of 0.82.

**Qualitative Instruments**

The instrument in qualitative research adopted from previous studies in the form of in-depth interviews [26]. This test aims to investigate the participants’ perceptions regarding the experience, benefit and challenges of following the aquatic-based Tabata. The interview was conducted in Bahasa for 30 minutes via the Whatsapp platform [44]. The results of interviews with participants were recorded and noted in a book, the results were analyzed by researchers and 3 experts in the sports training methods who have Doctoral degrees.

**Procedure**

Quantitative research was conducted from November-December 2022 at Nahdlatul Ulama University, West Nusa Tenggara (Indonesia). Before the research was carried out, the researcher had asked permission from the Nahdlatul Ulama University Committee of West Nusa Tenggara with number: 255/UNUTB/11/2022. In addition, this study was conducted according to the guidelines of the World Medical Association Code of Ethics (Helsinki Declaration for humans) and also strictly implemented the standard COVID-19 protocol, for example, before the training started all participants and the research team were checked for body temperature and used hand sanitizers. Quantitative research was conducted through experiments, the first meeting was held on November 1, 2022, and all participants carried out initial test activities, namely physical fitness tests. Then, the second meeting on November 3, 2022, the experimental group carried out the Aquatic-based Tabata training program until the 13th meeting (29 November 2022) and the 14th meeting (01 December 2022) all participants carried out the final test activity, namely a physical fitness test. Aquatic-based Tabata training is held in the morning at the swimming pool located at Nahdlatul Ulama University in West Nusa Tenggara (Indonesia). The aquatic-based Tabata program presented in Table 2.

Whereas qualitative research through in-depth interviews was carried out on December 3, 2022. The experimental group was interviewed for 30 minutes individually and the interview was conducted in Bahasa language. In this study, the interview only conducted for experimental group who received the Aquatic-based Tabata training program in accordance to this study objectives.

**Table 2**

<table>
<thead>
<tr>
<th>Training Unit Components</th>
<th>Activities</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warm-up</td>
<td>Prestretch and warm-up</td>
<td>2 min</td>
</tr>
<tr>
<td>Aquatic-Based Tabata</td>
<td>Squat Jump. High Knee. Tuck Jump. Kick front. Jumping Jack. Single movement was performed with a duration of 20 seconds and 10 seconds rest.</td>
<td>5 min</td>
</tr>
<tr>
<td>Cool-down</td>
<td>Cardiorespiratory cool down and the poststretch.</td>
<td>2 min</td>
</tr>
</tbody>
</table>

**Data analysis**

**Quantitative analysis**

Statistical analysis for quantitative data was processed using IBM SPSS 25.0 (Armonk, NY: IBM Corp). The steps were included normality testing (Shapiro-Wilk) and descriptive statistics namely mean (\( \bar{x} \)) and standard deviation (S). Meanwhile, the Independent samples t-test used to test differences in physical fitness values between the before and after of experiment. Paired sample t-test serves to test whether there is an effect of the experimental and control groups on the level of physical fitness. The significance level used was 0.05.

**Qualitative analysis**

Data obtained from qualitative research was analyzed qualitatively thematically, namely the results of in-depth interviews were coded and categorized into three themes [26], with details:

Theme 1: Benefit in using aquatic-based Tabata.
Theme 2: Challenges in using aquatic-based Tabata.
Theme 3: impacts in using Aquatic-based Tabata.
Results

The normality test results in this study were normally distributed (Table 3). Table 4 shows the results of the descriptive statistics which include the mean and standard deviation. Table 5 shows that there was no difference in the physical fitness of the athletes in the experimental and control groups before getting the experiment (Tabata-based aquatic) (p>0.05). Table 6 shows the results of the Paired sample t-test, where the aquatic-based Tabata training had a significant effect on increasing physical fitness (p<0.05), but there was no increase in physical fitness in the control group (p>0.05). While Table 7 shows that there are differences in the physical fitness of athletes in the experimental and control groups after getting the experiment (p<0.05).

Normality test calculation of participants of control and experimental groups

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Experimental Group</th>
<th>p</th>
<th>Control Group</th>
<th>p</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Fitness</td>
<td>Pre-Post</td>
<td>0.96</td>
<td>Pre-Post</td>
<td>0.166</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>Pre-Post</td>
<td>0.148</td>
<td>Pre-Post</td>
<td>0.130</td>
<td>Normal</td>
</tr>
</tbody>
</table>

Descriptive Statistics

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Experimental Group</th>
<th>Control Group</th>
<th>Statistical Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male (n=10)</td>
<td>Female (n=10)</td>
<td>Male (n=10)</td>
</tr>
<tr>
<td></td>
<td>Pre</td>
<td>Post</td>
<td>Pre</td>
</tr>
<tr>
<td>Leg dynamometer (kg)</td>
<td>31.10(1.96)</td>
<td>40.30(4.80)</td>
<td>22.10(2.28)</td>
</tr>
<tr>
<td>Squat jump (cm)</td>
<td>2.80(4.22)</td>
<td>3.90(3.16)</td>
<td>1.70(4.83)</td>
</tr>
<tr>
<td>Run test 10 meter (s)</td>
<td>4.40(5.16)</td>
<td>3.20(6.32)</td>
<td>6.20(7.89)</td>
</tr>
<tr>
<td>Shuttle run: 4×10 meters (s)</td>
<td>8.20(1.22)</td>
<td>5.60(6.99)</td>
<td>10.70(1.63)</td>
</tr>
<tr>
<td>Sit and reach test (cm)</td>
<td>5.11(1.05)</td>
<td>8.67(1.41)</td>
<td>5.00(8.16)</td>
</tr>
<tr>
<td>Multi-stage (ml/kg/min)</td>
<td>33.11(2.02)</td>
<td>43.67(3.00)</td>
<td>28.60(1.71)</td>
</tr>
</tbody>
</table>

The results of differences physical fitness on the experimental (n=20) and control (n=20) groups before the experiment

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Group</th>
<th>Statistical Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>t</td>
</tr>
<tr>
<td>Physical Fitness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leg dynamometer (kg)</td>
<td>Experimental</td>
<td>29.42</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>27.57</td>
</tr>
<tr>
<td>Squat jump (cm)</td>
<td>Experimental</td>
<td>2.25</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>2.35</td>
</tr>
</tbody>
</table>
The results of the Paired Samples t-test

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Experimental Group (n = 20)</th>
<th>Control Group (n = 20)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-Post Male</td>
<td>t</td>
</tr>
<tr>
<td>Legs dynamometer (kg)</td>
<td>9.20(4.15)</td>
<td>6.997</td>
</tr>
<tr>
<td>Squat jump (cm)</td>
<td>1.10(316)</td>
<td>11.000</td>
</tr>
<tr>
<td>Run test 10 meters (s)</td>
<td>1.20(632)</td>
<td>6.000</td>
</tr>
<tr>
<td>Shuttle run: 4x10 meters (s)</td>
<td>2.60(135)</td>
<td>6.091</td>
</tr>
<tr>
<td>Sit and reach test (cm)</td>
<td>3.55(159)</td>
<td>6.709</td>
</tr>
<tr>
<td>Multi-stage (ml/kg/min)</td>
<td>10.56(447)</td>
<td>7.076</td>
</tr>
</tbody>
</table>

The results of differences physical fitness on the experimental (n=20) and control (n=20) groups after the experiment

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Group</th>
<th>Statistical Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Fitness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Legs dynamometer (kg)</td>
<td>Experimental</td>
<td>35.53</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>29.76</td>
</tr>
<tr>
<td>Squat jump (cm)</td>
<td>Experimental</td>
<td>3.35</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>2.60</td>
</tr>
<tr>
<td>Run test 10 meter (s)</td>
<td>Experimental</td>
<td>3.00</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>4.75</td>
</tr>
</tbody>
</table>
The results of qualitative research through in-depth interviews with participants obtained the following findings:

**Theme 1: The benefit in using aquatic-based Tabata**

The first theme that was revealed through in-depth interviews was the participants' perceptions of the benefit in using Aquatic-based Tabata. In this case the participants argued that:

“We think Aquatic-based Tabata training was easy to implement, because we can learn a type of exercise such as tuck jump or squat jump quickly and this training was fun when carried out in water” (Interviewed with P1, P3, P5, P7, P8, P10)

“In our opinion, this training saves time, because we just practice for 5 minutes and we can sweating while working out” (Interviewed with P2, P4, P6, P9, P11).

We agree!..aquatic-based Tabata training is very easy, efficient, effective and we will continue to use this program in the future (Interviewed with P13, P14, P15, P17, P19). And some participants argue that:

“The aquatic-based Tabata training program is easy-to-remember and doesn’t require a lot of equipment, so we can learn them quickly and we think this is the right kind of training and should continue to be used in the future to improve physical fitness” (Interviewed with P12, P16, P18, P20).

**Theme 2: Challenges in using aquatic-based Tabata**

This second theme related to the difficulty in implementing an aquatic-based Tabata training program, it was expected that these challenges or obstacles can be minimized. In this case, some participants argued that:

"According to our perception, the aquatic-based Tabata training program cause psychological trauma to athletes who cannot swim or have a phobia of water, so that the exercises carried out later will be less than optimal" (Interviewed with P2, P4, P7, P10, P15).

This aquatic-based Tabata training program was categorized as high intensity workout, therefore the participants should warm up optimally and did not allow to joke during the training process, because it was possible to cause injury or cramps to the legs even though the risk was low (Interviews with P1, P3, P5, P6, P9, P13, P17).

**Other participants argued that:**

"We think this aquatic-based Tabata training program cannot be applied to pre-teens athletes or under 10 years old because the types of movements are too complex for them" (Interviewed with P8, P11, P12, P14, P16, P18, P19, P20).

**Theme 3: Impact of aquatic-based Tabata on physical fitness**

The final theme relates to the impact or benefits provided from the aquatic-based Tabata training program. Participants gave the opinion that:

“Aquatic-based Tabata training has a real impact or benefit on improving our physical fitness. For example, before participating in this training we often felt tired easily, but after participating in this training we feel that our physical fitness is better than before” (Interviewed with P1, P2, P3, P5, P6, P7, P8, P10).

That's right!!!..we can run faster and have harder kicks than before (Interviewed with P4, P11, P16, P17, P20). In fact, our jumping and flexibility are much better after conducting the aquatic-based Tabata training program (Interviewed with P9, P12, P13, P14). Then some participants argued:

“Our physical fitness is better than
previously, for example, we can practice for a long duration without experiencing extremely fatigue. We are lucky could participate in this training program and we will continue to use it to maintain our physical fitness level in the future” (Interviewed with P15, Q18, Q19).

Discussion

This study aims to investigate the effect of the aquatic-based Tabata training system to improve the physical fitness of athletes in situational sports through mixed research. The first finding in the quantitative study showed that there was no difference in the physical fitness of the experimental and control group athletes before the experiment. The second finding that aquatic-based Tabata training had a significant effect on increasing physical fitness, but there was no increase in physical fitness in the control group. The third finding is that there are differences in the physical fitness of the experimental and control group athletes after getting the experiment.

Aquatic-based Tabata training has been shown to have a positive effect on improving the physical fitness of situational sports athletes. It was due to Tabata's aquatic-based training presented exercises (e.g., squat jumps, high knees, tuck jumps, front kicks and jumping jacks) leading to increased physical fitness. In addition, Tabata was conducted in water (aquatic) has a heavier load than conducted on land, thus requiring much greater energy because the muscles work more optimally [45]. In addition, according to Pereira Neiva, Brandao Fail, Izquierdo, Marques, Marinho [46], that increased physical fitness can occur due to water and body loads combined with movements carried out at high speed. The findings are in line with previous studies which reported that aquatic-based training using high intensity can significantly improve components of physical fitness has increased [31, 47, 48]. Meanwhile, the control group did not show a significant increase in the athlete's physical fitness.

Qualitative findings in this study indicate that the majority of athletes gave positive perceptions of aquatic-based Tabata training, for example this training was easy and and did not require a lot of equipment. In addition, according to athletes, this training has a high level of impact in improving physical fitness [31]. Finally, there was several challenges in implementing aquatic-based Tabata such as it has potential to cause a low risk of injury, psychological trauma to athletes who cannot swim or have a phobia of water and cannot be applied to athletes at pre-teens.

Conclusions

Based on the study results and discussion, we concluded that aquatic-based Tabata training was proven had a major effect on improving physical fitness in situational sports. This research contributes to existing knowledge concerning the importance of using aquatic-based Tabata training, so that they can continue to use this training in a sustainable manner in the future. Finally, a number of limitations that need to be considered (i) a limited number of participants (athletes) who came from in situational sports (martial arts, football), (ii) the Aquatic-based Tabata training program cannot be implemented for all age athletes and it is only intended for athletes aged 15 years and above. Thus, future research needs to add more participants and come from several types of sports such as swimming, wrestling, handball. In addition, it is expected to create an aquatic-based Tabata training program that can be used for all age levels in athletes.

Conflict of interest

We hereby declare that there is no conflict of interest in this research.
References


44. Magee MK, White JB, Merrigan JJ, Jones MT. Does the multistage 20-m shuttle run test accurately predict vo2max in ncaa division i women collegiate field hockey athletes? Sports. 2021;9(6).


Information about the authors

Lalu Moh Yudha Isnaini
alumohyudhaisnaini@gmail.com
https://orcid.org/0000-0003-0487-3549
Faculty of Teacher Training and Education, Physical Education, Health and Recreation
Universitas Nahdlatul Ulama Nusa Tenggara Barat, Indonesia

Edi Setiawan
edisetiawanmpd@gmail.com
https://orcid.org/0000-0001-7711-002X
Faculty of Teacher Training and Education, Physical Education, Health and Recreation
Universitas Suryakancana, Indonesia

Ruslan Abdul Gani
ruslan.abdulgani@staff.unsika.ac.id
http://orcid.org/0000-0002-7608-1658
Faculty of Teacher Training and Education, Physical Education, Health and Recreation
Universitas Singaperbangsa Karawang, Indonesia

Luthfie Lufthansa
luthfie@budiutomomalang.ac.id
http://orcid.org/0000-0002-8777-8688
Fakultas pendidikan ilmu eksakta dan keolahragaan.
Universitas IKIP Budi Utomo, Indonesia

Novri Gazali
novri.gazali@edu.uir.ac.id
https://orcid.org/0000-0002-7968-1544
Faculty of Teacher Training and Education, Physical Education, Health and Recreation
Universitas Islam Riau, Indonesia

M. E. Winarno
m.e.winarno.fik@um.ac.id
https://orcid.org/0000-0002-2064-5418
Faculty of Sport Science
Universitas Negeri Malang, Indonesia

Інформація про авторів

Лалу Мох Юдха Існаїні
alumohyudhaisnaini@gmail.com
https://orcid.org/0000-0003-0487-3549
Педагогічний факультет, фізичне виховання, здоров’я та рекреація
Universitas Nahdlatul Ulama Nusa Tenggara Barat, Індонезія

Еді Сетіаван
edisetiawanmpd@gmail.com
https://orcid.org/0000-0001-7711-002X
Педагогічний факультет, фізичне виховання, здоров’я та рекреація
Університет Сурьяканакана, Індонезія

Руслан Абдул Гані
ruslan.abdulgani@staff.unsika.ac.id
http://orcid.org/0000-0002-7608-1658
Педагогічний факультет, фізичне виховання, здоров’я та рекреація
Universitas Singaperbangsa Karawang, Індонезія
Лутфі Люфтганза
luthfie@budiutomomalang.ac.id
http://orcid.org/0000-0002-8777-8688
Fakultas pendidikan ilmu eksakta dan keolahragaan.
Університет IKIP Budi Utomo, Індонезія

Новрі Газали
novri.gazali@edu.uir.ac.id
https://orcid.org/0000-0002-7968-1544
Педагогчий факультет, фізичне виховання, здоров'я та рекреація
Університет Іслам Ріау, Індонезія

М. Е. Вінарно
m.e.winarno.fik@um.ac.id
https://orcid.org/0000-0002-2064-5418
Факультет спортивних наук
Університет Негері Маланг, Індонезія

Информация об авторах

Лалу Мох Юдха Иснаини
alumohyudhaisnaini@gmail.com
https://orcid.org/0000-0003-0487-3549
Факультет педагогического образования и воспитания, физической культуры, здоровья и отдыха
Universitas Nahdlatul Ulama Nusa Tenggara Barat, Индонезия

Эди Сетиаван
edisetiawanmpd@gmail.com
https://orcid.org/0000-0001-7711-002X
Факультет педагогического образования и воспитания, физической культуры, здоровья и отдыха
Университет Сурабянганча, Индонезия

Руслан Абдул Гани
ruslan.abdulganis@staff.unsika.ac.id
http://orcid.org/0000-0002-7608-1658
Факультет педагогического образования и воспитания, физической культуры, здоровья и отдыха
Universitas Singaperbangsa Karawang, Индонезия

Луффи Люфтганза
luthfie@budiutomomalang.ac.id
http://orcid.org/0000-0002-8777-8688
Fakultas pendidikan ilmu eksakta dan keolahragaan.
Університет IKIP Budi Utomo, Індонезія

Новрі Газали
novri.gazali@edu.uir.ac.id
https://orcid.org/0000-0002-7968-1544
Факультет педагогического образования и воспитания, физической культуры, здоровья и отдыха
Університет Іслам Ріау, Індонезія

М. Є. Вінарно
m.e.winarno.fik@um.ac.id
https://orcid.org/0000-0002-2064-5418
Факультет спортивних наук
Університет Негері Маланг, Індонезія

This work is licensed under a Creative Commons Attribution 4.0 International License (CC BY 4.0)

Received: 2022-10-16     Accepted: 2022-11-19     Published online: 2022-12-12     Published: 2023-09-17