



ORIGINAL ARTICLES. SPORT

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

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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>

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How to Cite

Isnaini LMY, Setiawan E, Gani RA, Lufthansa L, Gazali N, Winarno ME. Aquatic-Based Tabata training: a training system to improve physical fitness of athletes in situational sports. *Health, Sport, Rehabilitation*. 2023;9(3):61-73. <https://doi.org/10.58962/HSR.2023.9.3.61-73>

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

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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 займалися 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 на основі водних видів спорту, і контрольну групу, яка проводила звичайні тренування. Кількісними інструментами для вимірювання фізичної підготовленості були тест на динамометрії ніг, стрибки з присідань, тести з бігу на 10 метрів, човниковий біг, сидячи і витягуйся та багатоетапний. Водночас якісний інструмент передбачав проведення глибинних інтерв'ю протягом 30 хвилин. Кількісний статистичний аналіз використовував IBM SPSS для отримання нормальної описової статистики. Тим часом t-критерій незалежних зразків використовувався для перевірки відмінностей у показниках фізичної підготовки до та після експерименту. T-тест парної вибірки слугує перевіркою впливу експериментальної та контрольної груп на рівень 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 заняттях мало значний вплив на підвищення фізичної підготовки ($p<0,05$), але не було підвищення фізичної підготовки в 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 спортсмени погодилися, що програма тренувань Табата, заснована на водних заняттях, була легкою, веселою та ефективною у використанні та економить час. Крім того, вони також припустили, що це тренування мало значний вплив на покращення фізичної підготовки, але це тренування також має проблеми, а саме його не можна застосовувати для спортсменів підліткового віку та має ризик спричинити травму, якщо спортсмени не проводили оптимальну розминку і несерйозно відносилися до виконання програми тренувань.

Висновки. У цьому дослідженні було зроблено висновок, що тренування табата на основі водних видів спорту доведено є одною з ефективних систем тренувань для покращення фізичної підготовки спортсменів у ситуаційних видах спорту.

Ключові слова: водні заняття табата, ситуаційні види спорту, фізична підготовка, змішаний метод

Аннотация

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Цель: 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 спортсмены, занимающиеся ситуационными видами спорта, а именно боевыми искусствами ($n=20$) и футболом ($n=20$). Ситуационные виды спорта – это виды спорта с изменяющейся обстановкой в ходе соревновательной деятельности. К ним относятся спортивные игры и боевые искусства. Участники были разделены на две группы, а именно экспериментальную группу, которая прошла водную тренировочную программу Табата, и контрольную группу, которая провела обычную тренировку. Количественными инструментами для измерения физической подготовленности были тесты на динамометр ноги, прыжки в приседе, бег на 10 метров, челночный бег, приседание и вытягивание и многоэтапный тест. При этом качественный инструмент предполагал проведение глубинных интервью продолжительностью 30 минут. Количественный статистический анализ использовал IBM SPSS для получения нормальности, описательной статистики. Между тем, t-критерий независимых выборок использовался для проверки различий в значениях физической подготовки до и после эксперимента. Парный выборочный t-критерий служит для проверки наличия влияния экспериментальной и контрольной групп на уровень физической подготовленности. Качественный статистический 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 ($p>0,05$). Вторым выводом о том, что табата-тренировка в водной среде оказала значительное влияние на повышение физической подготовленности ($p<0,05$), но в контрольной группе повышения физической подготовленности не было ($p>0,05$). Третий 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 программа тренировок Табата на водной основе была простой, увлекательной и эффективной в использовании и сэкономила время. Кроме того, они также предположили, что эта тренировка оказала большое влияние на улучшение физической формы, но 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 несерьезно относились к выполнению тренировочной программы.

Выводы. Это исследование показало, что табата-тренировка в водной среде оказалась 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.

Partisipants

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 Whatsapps, 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 detail about characteristics of participants are presented in Table 1.

Table 1

The Characteristics of Participants

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

Instruments

Quantitative Instruments

Quantitative instruments was 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 straighten 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 an athlete'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 conducting by calculating the number of levels and return that was



obtained then it was converted into Vo2max. 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 was 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

Aquatic-Based Tabata Program

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

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 was 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 ($p < 0.05$).

Table 3

Normality test calculation of participants of control and experimental groups

Dependent Variable	Experimental Group	p	Control Group	p	Description
Physical Fitness	Pre-Post	0.96	Pre-Post	0.166	Normal
	Pre-Post	0.148	Pre-Post	0.130	Normal

Table 4

Descriptive Statistics

Dependent Variable	Experimental Group				Control Group			
	Male (n=10)		Female (n=10)		Male (n=10)		Female (n=10)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
	\bar{X} (S)	\bar{X} (S)	\bar{X} (S)	\bar{X} (S)	\bar{X} (S)	\bar{X} (S)	\bar{X} (S)	\bar{X} (S)
Physical Fitness								
Leg dynamometer (kg)	31.10(1.96)	40.30(4.80)	22.10(2.28)	30.20(3.61)	30.30(2.83)	33.40(6.09)	23.40(3.27)	26.10(3.07)
Squat jump (cm)	2.80(.422)	3.90(.316)	1.70(.483)	2.80(.422)	2.80(.422)	3.30(1.05)	1.90(.568)	2.20(.919)
Run test 10 meter (s)	4.40(.516)	3.20(.632)	6.20(.789)	4.50(.527)	4.40(.516)	3.70(1.25)	6.20(.789)	5.80(.789)
Shuttle run: 4x10 meters (s)	8.20(1.22)	5.60(.699)	10.70(1.63)	8.20(.632)	8.00(1.49)	7.30(2.16)	6.40(.699)	6.00(.816)
Sit and reach test (cm)	5.11(1.05)	8.67(1.41)	5.00(.816)	8.30(1.41)	4.33(1.32)	5.11(1.05)	5.00(1.32)	5.22(1.30)
Multi-stage (ml/kg/min)	33.11(2.02)	43.67(3.00)	28.60(1.71)	39.60(2.98)	34.67(1.41)	37.67(4.35)	30.50(2.06)	33.20(4.73)

Table 5

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

Dependent Variable	Group	Statistical Indicators			
		\bar{X}	S	t	p
Physical Fitness					
Leg dynamometer (kg)	Experimental	29.42	7.13	0.937	0.355
	Control	27.57	5.29		
Squat jump (cm)	Experimental	2.25	0.716	0.456	0.651
	Control	2.35	0.671		



Run test 10 meter (s)	Experimental	3.05	1.46	1.800	0.080
	Control	3.90	1.51		
Shuttle run: 4x10 meters (s)	Experimental	7.00	1.29	0.469	0.642
	Control	7.20	1.39		
Sit and reach test (cm)	Experimental	6.95	2.66	1.568	0.125
	Control	5.75	2.14		
Multi-stage (ml/kg/min)	Experimental	30.85	2.90	1.709	0.096
	Control	32.44	2.83		

Table 6

The results of the Paired Samples t-test

Dependent Variable	Experimental Group (n = 20)						Control Group (n = 20)					
	Pre-Post	t	p	Pre-Post	t	p	Pre-Post	t	p	Pre-Post	t	p
	Male			Female			Male			Female		
	\bar{X} (s)	\bar{X} (s)	\bar{X} (s)	\bar{X} (s)								
Physical Fitness												
Leg dynamometer (kg)	9.20(4.15)	6.997	0.000	8.10(3.44)	7.432	0.000	3.10(5.74)	1.707	0.122	2.70(4.24)	2.012	0.075
Squat jump (cm)	1.10(.316)	11.000	0.000	1.10(.316)	11.000	0.000	0.500(1.17)	1.342	0.213	0.300(1.16)	0.818	0.434
Run test 10 meters (s)	1.20(.632)	6.000	0.000	1.700(.675)	7.965	0.000	0.700(1.41)	1.561	0.153	0.400(1.26)	1.000	0.343
Shuttle run: 4x10 meters (s)	2.60(1.35)	6.091	0.000	2.50(1.26)	6.228	0.000	0.700(1.16)	1.909	0.089	0.400(1.07)	1.177	0.269
Sit and reach test (cm)	3.55(1.59)	6.709	0.000	3.30(1.16)	9.000	0.000	0.778(1.48)	1.575	0.154	0.222(1.20)	0.555	0.594
Multi-stage (ml/kg/min)	10.56(4.47)	7.076	0.000	11.00(2.26)	15.386	0.000	3.00(5.22)	1.724	0.123	2.70(4.94)	1.727	0.118

Table 7

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

Dependent Variable	Group	Statistical Indicators			
		\bar{X}	S	t	p
Physical Fitness					
Leg dynamometer (kg)	Experimental	35.53	6.69	2.905	0.006
	Control	29.76	5.85		
Squat jump (cm)	Experimental	3.35	0.671	2.459	0.019
	Control	2.60	1.18		
Run test 10 meter (s)	Experimental	3.00	0.562	4.937	0.000
	Control	4.75	1.48		



Shuttle run: 4×10 meters (s)	Experimental	5.05	0.82	3.741	0.001
	Control	6.65	1.72		
Sit and reach test (cm)	Experimental	8.30	1.174	8.654	0.000
	Control	4.75	1.410		
Multi-stage (ml/kg/min)	Experimental	41.70	3.57	4.748	0.000
	Control	35.30	4.85		

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 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.



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