



AKADÉMIAI KIADÓ

# Acute mental benefits of aquatic exercises in middle-aged women

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RESEARCH ARTICLE



## ABSTRACT

**Background and aims:** Aquatic exercises are popular leisure activities worldwide, primarily among women. These activities are especially beneficial for aging people and individuals having difficulties performing land-based exercises. Their physical health benefits have already been documented in the academic literature, but research on their mental health effects is still non-existent. However, leisure exercises promoting mental health are advantageous in a fast-paced and often stressful world. Therefore, in this *in-situ* (natural life setting) field study, we examined the acute mental benefits of aquatic exercises in 30 voluntary consenting women having a mean age of 57.57 (SD = 12.67) years. **Methods:** Using a within-participants research design, the subjectively perceived feeling states and felt arousal, along with positive and negative affect, were recorded before and after exercise. Moreover, the personal expectancies regarding the expected feelings after exercise were assessed before the workout to determine the influence of anticipation effects. **Results:** The findings revealed that core affect and positive affect improved substantially from before to after exercise ( $p < .001$ ), as confirmed by the large effect sizes (Cohen's  $d > 0.80$ ). Negative affect decreased nonsignificantly ( $p = .062$ ), but it was already low before exercise. Although expectancy scores were high before the exercise class, they did not correlate ( $p > .05$ ) with the dependent measures' magnitude of changes (pre-class – post-class scores). **Conclusions:** These findings suggest that women who participate in an aquatic exercise class report experiencing significant positive changes in their feelings, demonstrating this popular exercise's acute mental health benefits. Although further controlled research is needed in this area, the current results have promising implications for middle-aged women's mental health preservation and promotion.

## KEYWORDS

aquafitness, swimming, water sports, mood, women

## A vízitorna akut mentális előnyei középkorú nőknél

### ABSZTRAKT

**Háttér és célkitűzés:** A vízitorna ma már világszerte egy népszerű szabadidős mozgásforma, elsősorban a nők körében. Ez a testedzés különösen előnyös az idősödő és egyéb edzést nehezen végző egyének számára. A vízitorna fizikai egészségre gyakorolt pozitív hatását már dokumentálták a szakirodalomban, de a mentális egészségre gyakorolt hatását eddig még nem vizsgálták, annak ellenére, hogy a mentális egészséget megőrző szabadidősport fontos a mai felgyorsult, stresszel teli világban. Ezért ebben az *in situ* (természetes élethelyzet) kutatásban a vízitorna akut mentális hatását vizsgáltuk 30 önkéntes nőnél, akiknek átlagéletkora 57,57 (SD = 12,67) év volt. **Módszerek:** A közérzetet, éberségi állapotot és a pozitív és negatív affektivitást edzés előtt és után kérdőívekkel vizsgáltuk. Ezen felül az edzésből következő (elvárt) érzéseket is felmértük az edzés előtt, hogy megvizsgáljuk az elvárás hatását. **Eredmények:** Az eredmények azt mutatták, hogy az affektivitás jelentősen javult ( $p < 0,001$ ) az edzés után, amit nagy hatásméretetek is megerősítettek (Cohen- $d > 0,80$ ). A negatív affektivitás csökkent, de nem szignifikánsan ( $p = 0,062$ ), mert már az edzés előtt is alacsony volt. Bár a pozitív hatást illetően az elvárás magas volt a vízi torna előtt, ez nem korrelált szignifikánsan ( $p > 0,05$ ) a pozitív változások nagyságrendjével (óra előtti – óra utáni mérések). **Következtetések:** Ezek az eredmények azt sugallják, hogy vízitornát választó nők jelentős pozitív változásokat tapasztalhatnak az edzés után, bizonyítva ennek a népszerű rekreációs sportnak a mentális egészségre gyakorolt akut pozitív hatását. Bár ezen a területen további randomizált kontroll csoportos kutatásokra van szükség, a jelen eredmények ígéretesek a középkorú nők mentális egészségének megőrzésére irányuló szabadidőmozgást megcélzó egészségügyi intervenciókban.

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## KULCSSZAVAK

aquafitness, úszás, vízisportok, hangulat, nők

## 1. INTRODUCTION

A single session of physical exercise usually improves *affect* (Kovácsik & Szabo, 2019), defined as the psychological feeling state reflecting how an activity or situation affects the person (Duncan & Barrett, 2007). Several exercises have acute affective benefits; aerobics, dancing, Nordic walking, Pilates, running, shadowboxing, spinning, swimming, golf, taekwondo, tai chi, walking, yoga, and several others (Kovácsik & Szabo, 2019).

Aquatic exercises are gentle forms of leisure exercises preferred mainly by women. They consist of various in-water activities suitable for all ages. It is especially beneficial for people unable to exercise on land or who find land-based exercises difficult and older people (Batterham, Heywood, & Keating, 2011). Its physiological benefits on the cardiovascular and musculoskeletal systems are already well documented (Barker et al., 2015). For example, a systematic literature review and meta-analysis (SLRMA) concluded that aquatic exercise could reduce pain while improving the physical functioning of patients suffering from low back pain (Shi et al., 2018). Another SLRMA found that aquatic exercises and land-based exercises have similar effects on dynamic balance in individuals aged 65 years or older; therefore, aquatic exercises are a good alternative to land-based exercises in improving dynamic balance and possibly reducing the risk of falls (Kim, Vakula, Waller, & Bressel, 2020). A very recent SLRMA (Song & Oh, 2022) concluded that aquatic exercises effectively alleviate pain and joint dysfunction while improving the quality of life for osteoarthritic patients.

Despite the many physical benefits of aquatic exercises, their mental benefits, paramount in the motivation and maintenance of the activity, as predicted by the Hedonic Theory (Higgins, 1997), have not been examined to date. The Hedonic Theory also posits that people generally choose activities that yield satisfaction and joy. As such, they contribute to the mental well-being of the individual. Furthermore, aquatic exercises are usually performed in a group setting, adding a social component to the exercise environment and facilitating social support in adherence to exercise (Wilson, 2021).

In the preliminary investigation of the acute psychological benefits of an exercise, it is helpful to rely on the *core affect*, a two-dimensional construct characterized by affective valence (ranging from feeling states of pleasure to displeasure) and level of perceived arousal (Russell, 2003). Core affect is a simple non-reflective subjective feeling state, such as feeling good or bad, lethargic or energized (Russell, 2003). Therefore, it is a dynamic index of the conscious *overall* momentary feelings which emerge as (1) high-arousal, pleasant affect (e.g., excited), (2) high-arousal, unpleasant affect (e.g., anxious), (3) low-arousal, unpleasant affect (e.g., sad) and (4) low-arousal, pleasant affect (e.g., relaxed; refer to Fig. 1). In addition to the core affect,

positive- and negative-affect, drifting in the opposite direction in response to exercise, could support (or refute) the results reflected by the core affect. However, *expectancies* might influence the findings and, thus, it was advised to assess expectancies in studies examining the acute psychological changes after exercise (Lindheimer et al., 2020).

The objective of the current work was to determine whether participants in an aquatic exercise class experience mental health benefits, determined based on feeling states and felt arousal, after aquatic exercises. Such benefits fuel the intrinsic motivation through *pleasure* derived from the activity, as described by the Hedonic Theory (Higgins, 1997). Therefore, a positive affective experience can foster adherence to the behavior. Considering the Hedonic Theory, the strength of engagement in a chosen activity affects the outcome, or the reward value, via its contribution to the individual's intrinsic motivation to engage in that activity (Higgins, 2006), reflected in the *expectation* associated with the outcome. Therefore, we also examined the relationship between *expectations* and changes in affect after aquatic exercises. We used a within-participants research design. The participants acted as their own control because it is difficult to select an adequate control activity and control group for aquatic exercises due to their multi-component nature (dance, music, rhythm, pool environment, instructor) and individual preferences, attitudes, expectations, skills, and abilities.

## 2. METHODS

### 2.1. Participants and procedure

We only studied women for two reasons. The first was that this study relied on a planned real-life aquatic exercise class attended by women only. The second reason was that significantly more women practice this leisure exercise than men (Statista Research Department, 2015).

We calculated the minimum required sample size with the G\*Power software (Version 3.1.9.7; Faul, Erdfelder, Lang, & Buchner, 2007) for a one-sample t-test (difference from baseline) using the following input parameters: alpha ( $\alpha$ ) = .05, power  $[1-\beta]$  = .80, medium effect size  $d$  = 0.50, according to which the minimum required sample size was 27.

The sample consisted of 30 consenting middle-aged women ( $M_{\text{age}} = 57.57$  years,  $SD = 12.67$  years) taking part in an aquatic exercise class in the Szérűskert swimming pool in the third district Budapest, Hungary.

All participants signed an informed consent form. The study was anonymous and the participants completed pre-coded questionnaires that were not matched to any personal data. Further, they did not receive any compensation for participation in the study, but the instructor shared the groups results with all. The here-reported research received



ethical clearance from the Research Ethics Committee of the Faculty of Education and Psychology at ELTE Eötvös Loránd University, Budapest, Hungary (certificate number 2018/139). The work fully conformed to the World Medical Association Declaration of Helsinki (2013) Ethical Principles for Medical Research Involving Human Subjects.

## 2.2. Measures

The *Feeling Scale* (FS; Hardy & Rejeski, 1989) FS gauges affective valence along a pleasure–displeasure spectrum. Verbal cues are visually (on paper) provided that assist participants in subjectively appraising the *single item scale* ranging from +5 to –5: +5 (very good), +3 (good), +1 (relatively good); 0 (neutral), –1 (relatively bad), –3 (bad); and –5 (very bad). The participants are asked to indicate the appraisal of their feelings at the very moment of the completion.

The *Felt Arousal Scale* (FAS; Svebak & Murgatroyd, 1985) gauges the subjectively appraised activation along a 6-point *single item* scale ranging from low arousal (1) to high arousal (6). Verbal cues are usually provided visually (on paper in this case). High arousal is analogous to states reflecting excitement, anxiety, and anger. Low arousal is analogous to perceived somatic states of relaxation, calmness, or boredom. The participants are instructed to indicate their appraised feelings at the moment of the completion. The FS and FAS have been widely used in past research (Buscombe & Inskip, 2013). Jointly the FS and FAS yield a measure of the core affect reflecting the momentary overall feeling of the individual (Russell, 2003). Since the FA and FAS are single-item scales, no internal reliabilities are available.

We also used the the Hungarian version (Gyollai, Simor, Köteles, & Demetrovics, 2011) of the 10-item *Positive and Negative Affect Schedule* (PANAS; Thompson, 2007). The PANAS measures positive and negative affect, both with five items, which are rated on a 5-point Likert scale, ranging from 1 (not at all) to 5 (very much). A sample item of positive affect is (feeling) ‘inspired’ at this moment, while a sample item for negative affect is ‘hostile’. The short version of the Hungarian PANAS has good psychometric properties and internal reliabilities ranging between .73 and .79 for positive affect and .65 and .67 for negative affect (Gyollai et al., 2011).

Finally, similar to Szabo, Jobbágy, and Köteles (2018), we used a 5-point *single item* Likert scale, ranging from 1 (very bad) to 5 (very good), to assess the *subjectively expected effects of the exercise class* on the after-exercise feeling states of the participants.

## 2.3. Intervention

First, participants indicated their expectancy concerning the effects of their exercise (after the termination of the exercise class) on their feelings by using the single-item rating scale. Next, they completed the FS, FAS, and PANAS.

Subsequently, the exercise class started. The exercise in a 1.4 m, 28° C pool lasted 60 minutes while rhythmical music played in the background. The second author, a qualified aquatic exercise instructor, presented the movements (i.e., jogging, trunk, leg and arm rotations, balance, and stretching). Participants completed the FS, FAS, and PANAS within five minutes following the exercise for a second time.

## 2.4. Statistical analyses

The paper and pencil data were coded and transcribed into an SPSS (Statistical Package for Social Sciences, V.26) file used for the statistical analyses. To test the hypothesis that the aquatic class induced changes in psychological measures, we used bootstrapped one-sample *t*-tests. We also calculated Cohen’s effect sizes (*d*). According to Cohen (1988) an effect size of 0.2 reflects small differences, a value of 0.5 moderate differences and a value of 0.8 or above reflects large differences. In addition, we employed Pearson’s correlations to examine whether expectancies have affected the *magnitude of changes* in the dependent measures. Finally, we plotted FS and FAS means to visually inspect the switch in core affect due to a one-hour aquatic exercise.

## 3. RESULTS

The descriptive statistics for four dependent measures before and after exercise, along with the percent changes, are illustrated in *Table 1*. Before the statistical analyses of the data, we calculated the change or *delta* ( $\Delta$ ) scores by subtracting the after-exercise scores from the pre-exercise scores. Subsequently, we subjected the change scores to four Bonferroni corrected one sample *t*-tests by using bootstrapping method (1,000 samples). After adjusting the level of statistical significance ( $\alpha = .0125$ , rounded to .01), the test results were significant for the feeling states, felt arousal, and positive affect (*Table 2*). Although negative affect decreased slightly, the magnitude of the change only approached the level of statistical significance. However, the mean negative affect score was already low before the exercise class, as seen in *Table 1*. It is noteworthy to mention that the effect sizes associated with the statistically significant results were large (*Table 2*).



**Table 1.** Descriptive statistics and ranges of ratings in five dependent measures before and after aquatic exercise class ( $n = 30$ )

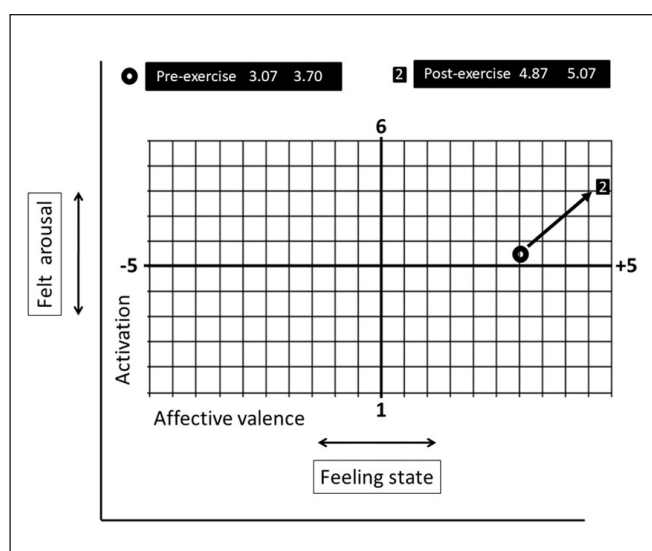
Dependent measures	Before exercise <i>M</i> ( <i>SD</i> )	After exercise <i>M</i> ( <i>SD</i> )	Percent (%) change	Range of ratings (min. – max.)
Expectation	4.57 (0.73)	–	–	1 – 5
Feeling state	3.07 (1.46)	4.87 (0.43)	58%	–5 – +5
Felt arousal	3.70 (0.92)	5.07 (0.79)	37%	1 – 6
Positive affect	3.82 (0.65)	4.37 (0.61)	14%	1 – 5
Negative affect	1.14 (0.22)	1.05 (0.14)	8%	1 – 5

**Table 2.** Results of the bootstrapped (1,000 samples) one-sample *t*-tests, testing the hypothesis that the change scores (delta [ $\Delta$ ]) in the dependent variables is greater than zero

Measures	<i>t</i>	df	<i>p</i> (2-tailed)	Mean Difference	95% Confidence Interval of the Difference		Effect size (Cohen's <i>d</i> )
					Lower	Upper	
$\Delta$ Feeling state	6.70	29	< .001	1.80	1.25	2.35	1.22
$\Delta$ Felt arousal	6.15	29	< .001	1.37	0.91	1.82	1.12
$\Delta$ Positive affect	4.79	29	< .001	0.55	0.31	0.78	0.87
$\Delta$ Negative affect	–1.94	29	.062	–0.09	–0.18	0.05	0.38

Note: Using the Bonferroni correction method, the acceptable alpha ( $\alpha$ ) level was .01.

Given that both feeling states and felt arousal changed in the positive direction (increased), there was a positive shift in *core affect*, too, as illustrated in Figure 1 by the intersection of the two variables.



**Figure 1.** The approximate shift in *core affect* (the intersection points of mean felt arousal and mean feeling states, with exact values shown in the black squares on the top of the graph), before exercise (illustrated as a circle) and after exercise (displayed as a square with number 2)

The expectancy scores were correlated with the change scores to examine whether the magnitude of changes in the dependent measures were associated with the expectancies concerning the positive mental effects of exercise. Although high at the beginning of the exercise class (4.57/5; see Table 1), the expectancy scores did not correlate with the magnitude of the change scores in any of the measures (feeling states  $r = .14$ ,  $p = .46$ ; felt arousal  $r = .11$ ,  $p = .57$ ; positive affect  $r = .16$ ,  $p = .40$ ; and negative affect  $r = .25$ ,  $p = .19$ ).

#### 4. DISCUSSION

The results of this exploratory work reveal that feeling states, felt arousal, and positive affect improved substantially after an aquatic exercise class in middle aged women. Obtaining large effect sizes (Cohen's  $d$ ) for three out of four dependent measures seems to underpin the robustness of the findings. Indeed, the effect sizes noted here were large (i.e.,  $d > 0.80$ ; Cohen, 1988) compared to small-to-medium effect sizes observed in positive affect induced by spinning (Szabo, Gáspár, Kiss, & Radványi, 2015) or by Aikido training (Szabolcs, Szabo, & Köteles, 2019). These significant changes in *core affect* and positive affect are noteworthy considering that participants had a very low (1.14 vs. 1.0, the minimum value) negative affect at the beginning of the class. This low initial value is most likely the primary reason why merely an 8% decrease was noticed in negative affect



after the exercise class, which approached but did not reach statistical significance. These findings, then, are attributable to floor effects.

Importantly, the lack of correlation between pre-exercise expectation ratings and delta or change scores suggests that the results are unrelated to pre-exercise expectancy effects. There is evidence from the literature that expectancy can enhance the positive effects of exercise (Flowers, Freeman, & Gladwell, 2018). Furthermore, there is a theory that expectancy-related psychological effects of acute exercise are due to placebo effects (Szabo, 2013). This theory is supported by a meta-analysis showing that about half of the positive psychological benefits of acute exercise are due to placebo effects (Lindheimer, O'Connor, & Dishman, 2015). Hence, it is essential to gauge expectancies in field research that test the affective changes induced by various forms of exercise to account for possible placebo effects. In the current study, the lack of relationship between expectancy and change scores suggests that placebo effects were unlikely to mediate the findings.

The large changes in both feeling states and felt arousal (refer to *Table 1*) shifted core affect close to the highest position on the *high arousal – positive feeling* quadrant (*Figure 1*). This shift is noteworthy because the initial values of core affect were already in this quadrant. Thus, participants felt good and activated before the class and reported high expectancy linked to their anticipated feeling states after exercise. However, as noted above, these high expectancy scores did not correlate with the *magnitude of changes* in the dependent measures. A similar pattern of exercise response was recently reported by Laki, Ihász, and Szabo (2022) in adolescent basketball players and earlier in cheerleaders (Kovacsik & Szabo, 2019). Hence, the mere anticipation of exercise could influence pre-exercise core affect. This conjecture, however, begs for longitudinal scrutiny.

The significant rise in feeling states (58%; *Table 1*) may not be attributable solely to movement but rather to a set of complex interactions in socio-environmental characteristics of the aquatic exercise class. Indeed, such interactions occur between the type of music, instructor, group participants, group size, and the physical environment, all of which are inseparable and comprise this form of exercise. Therefore, aquatic exercises are complex artistic, social, and fitness activities that are most adequately studied in whole rather than in parts, similar to dance, which also involves many of the components present in aquatic exercise. Consequently, aquatic exercise should be evaluated and studied within the framework of dance studies encompassing different

routines, forms, and environments that yield consistent and substantial health benefits (Schwender, Spengler, Oedl, & Mess, 2018). Further, these gentle exercises' long-term mental health benefits also merit research attention, considering the popularity of this leisure activity among women and its suitability for older people and individuals with movement difficulties in land-based exercises.

There are limitations to the current study. The first is that the examined volunteer sample may not be representative of the middle-aged female population. The second is that different aquatic environments, instructors, and music may affect the results differently. Third, we had no data on the health status of the participating women, which could also affect the psychological measures. Fourth, although the sample size was sufficient based on the a priori calculation of the statistical power, the number of women studied in this field experiment is low. Therefore, the findings and conclusions should be interpreted by keeping these limitations in perspective.

## 5. CONCLUSION

To the authors' best knowledge, this study is the very first to show that participation in an aquatic exercise class results in substantial acute positive affective changes *independent of the high expectations* before the exercise. Based on the Hedonic Theory (Higgins, 1997), the observed positive changes, reflecting pleasure derived from the activity, may act as intrinsic reward and source of motivation for the activity, which is especially important if the aquatic exercise is performed for health preservation or rehabilitation (Barker et al., 2015). Future randomized controlled studies are needed to establish the specific role and mechanism of aquatic exercises in promoting mental health in various age groups and among men and women.

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**Authors' contribution:** Krisztina Ábel: conceptualization, design, writing. Fruzsina Somlai: data collection, data reduction, intervention. Attila Szabo: conceptualization, statistical analyses, supervision, writing.

**Conflict of interest:** The authors have no conflict of interest to declare.



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