

# Mood and well-being of novice open water swimmers and controls during an introductory outdoor swimming programme: A feasibility study

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## Abstract

**Background:** Anecdotal evidence suggests that outdoor swimming can improve mood. This feasibility study examined the mood and well-being in participants attending an outdoor swimming course.

**Methods:** Profile of Mood States and Short Warwick–Edinburgh Mental Well-being Scale questionnaires were completed by participants on a 10-week introductory outdoor swimming course (61 swimmers) and 22 controls who sat on the beach. Questionnaires were completed before and after three sessions: the first session (pool based), their first outdoor swim (session 4) and their final outdoor swim (session 10).

**Results:** Swimmers reported acute increases in positive subscales (Esteem and Vigour,  $P < .001$ ) and reductions in negative subscales (Tension, Anger, Depression, and Confusion and Total Mood Disturbance [TMD],  $P < .001$ ,  $d = 1.1$ – $1.7$ ). TMD was also reduced between sessions ( $P < .001$ ,  $d = 0.08$ ). Well-being also increased during the course in swimmers ( $P < .001$ ,  $d = 3.7$ ) and controls ( $P = .019$ ,  $d = 0.2$ ). Greater reductions in TMD ( $P < .001$ ,  $d = 0.8$ – $2.5$ ) and increases in well-being were observed in swimmers than controls ( $P = .034$ ,  $r = .23$ ).

**Conclusions:** Novice outdoor swimmers participating in a 10-week introductory outdoor swimming course had acute and chronic reductions in negative mood, increases in well-being and acute increases in positive mood. Controls mood scores fluctuated and were similar at the start and end of the course, whereas well-being scores improved

**Abbreviations:** POMS, Profile of Mood States; SWEMWBS, Short Warwick–Edinburgh Mental Well-being Scale; TMD, Total Mood Disturbance

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by the final session. Tension scores peaked in both swimmers and controls immediately before the first outdoor swim. Nonetheless the swimmers' improvement in mood and well-being scores was significantly greater than that of the controls. The nature of the study does not provide mechanistic understanding; there are likely to be a number of explanations (physiological, psychological and sociological) for the changes in mood and well-being in swimmers and controls that can be investigated further.

**KEYWORDS**

blue space, mental health, open water swimming

## 1 | INTRODUCTION

Current physical activity for health guidance states that each person should take at least 150 min of moderate to vigorous physical activity each week.<sup>1</sup> However, globally, 23.4% of males and 31.7% of females would be deemed physically inactive.<sup>2</sup> The benefits of physical activity are well documented and include a reduced risk of developing both physical and mental health problems and can support treatment of pre-existing health conditions.<sup>3,4</sup> Therefore, it is important that sedentary individuals find a form of activity that they enjoy, are motivated to continue and thus more likely to adhere to,<sup>5</sup> consequently, enhancing quality of life and reducing the healthcare burden.

Land-based activities such as Park Run have introduced and encouraged large numbers of non-runners or occasional runners, particularly from sectors of the population that traditionally have lower activity levels, for example, women, overweight people and older adults.<sup>6</sup> The regular use of outdoor environments for exercise or physical activity provides opportunities for changing indices of mood, well-being and mental health.<sup>7-10</sup> In addition, Mitchell<sup>9</sup> suggests that exercise in natural environments is associated with a greater reduction in the risk of poor mental health in comparison to other built environments. Therefore, it appears that there is a role for 'green' activity or exercise in improving and maintaining good mental health, and reaches populations that may otherwise be inactive.

Similarly, a large body of anecdotal evidence exists suggesting a link between outdoor swimming and improved mental health.<sup>11</sup> Many anecdotes discuss the 'post swim high' swimmers feel after their swim.<sup>12</sup> In fact this anecdotal information may be part of the reason for the growth in popularity of the activity as both a sport and pastime.<sup>13-15</sup> Qualitative enquiries present evidence of a therapeutic influence, in that the lived experiences of outdoor swimming elevated both physical and mental health and well-being<sup>10,16-18</sup> and were transformative, connecting and re-orientating for participants.<sup>19</sup>

Previous research has surveyed and compared cold water 'winter' swimmers and age-matched controls before and after the winter swimming season.<sup>20</sup> They found no differences between the two groups in mood before the winter swimming season, but found significant reductions in fatigue and increased vigour in the swimmers after the winter swimming season. The use of independent groups means that it is not clear if the changes in mood observed occur as a consequence of

winter swimming or other differences in the groups, and if the changes in mood occur acutely or take time to manifest. Therefore, it was hypothesised that there would be acute as well as longer term changes in mood and well-being in a group of novice outdoor swimmers as a consequence of participation in an introductory outdoor swimming programme.

## 2 | METHODS

### 2.1 | Participants

Participants (57 females and seven males aged  $43 \pm 10$  years [Figure 1], all could swim 400 m in an indoor heated swimming pool, 59 were novice sea swimmers and two had some limited experience) were recruited from the customers of Brighton Swimming School and Portsmouth Outdoor Swimming as a convenience sample. An additional 22 people observed all of the surveyed sessions and acted as the control group. The controls were friends or family members of the swimmers who were there to support them and at the swimming location on each survey occasion. They were recruited through the swimmers, but separately asked if they would consent to take part in the study. All swimmers and controls resided in the United Kingdom, and swimmers self-certified their health was adequate to swim in open water. Swimmers and controls alike gave their written informed consent to participate in this non-randomised prospective cohort study that was given a favourable opinion by the University of Portsmouth Science Faculty Ethics Committee (SFEC 2018-016). The programme involved a 1-h coached session each week for 10 weeks, running from April to July 2018 in Brighton and a similar course run in Portsmouth from April to July 2019.

### 2.2 | Intervention and control groups

The first 3 weeks of coaching were pool based, building the skills and confidence needed to swim outdoors; there were also several seminar sessions to explain what additional equipment swimmers may need and how to put on and swim in a wetsuit. This was then followed by 7 weeks of coached outdoor swimming; all participants wore wetsuits during

sea swims and fully participated in all sessions. The duration of stay in the sea was self-determined and subject to the weather and sea conditions. The coaching team ensured the health and safety of all swimmers during and after their swimming sessions. During each session, the controls either sat or stood watching the swimmers. For pool-based sessions, controls were away from the pool side on the swimming pool balcony; and during outdoor sessions they were on the beach, close to the swimmers clothing or bag.

## 2.3 | Outcome measures and procedures

The abbreviated Profile of Mood States (POMS) questionnaire<sup>21</sup> and Short Warwick-Edinburgh Mental Well-being Scale (SWEMWBS)<sup>22</sup> were administered to swimmers and controls before the first pool session, the first sea swim (session 4), and the final sea swim (session 10). The POMS was also administered immediately after the same sessions to both swimmers and controls. The controls were inactive during the sessions and either stood or sat for the duration on the swimming pool balcony (session 1) or on the beach (sessions 4 and 10).

The abbreviated POMS is a 40-item questionnaire that asked participants to rate their mood across seven subscales (tension, fatigue, depression, anger, confusion, esteem and vigour) on a 5-point scale ranging from “not at all” (0) to “extremely” (4). A Total Mood Disturbance (TMD) score was calculated by using Equation 1. Cronbach's alpha values for each of the subscales of the questionnaire ranged from 0.664 (Depression subscale) to 0.954 (Fatigue subscale).

$$\begin{aligned} \text{Total Mood Disturbance (TMD)} = & (\text{tension} + \text{fatigue} + \text{depression} \\ & + \text{anger} + \text{confusion}) - (\text{esteem} + \text{vigour}) + 100 \end{aligned} \quad (1)$$

The SWEMWBS<sup>22</sup> (Cronbach's alpha values 0.83–0.85) was administered before the first pool session, before the first sea swim and before the final sea swim, to examine the effect on well-being during the swimming programme. The scale consisted seven items, responses ranged from 1 (none of the time) to 5 (all of the time) on a 5-point Likert scale. Individual indices were recorded; the total of the raw item-scores calculated and adjusted in accordance with Stewart-Brown et al.<sup>23</sup> This shorter scale was preferred to the full version for brevity, but has a strong correlation with the original survey ( $r = .954$ ).<sup>23</sup> The change in well-being level (low well-being 7–19 points, moderate well-being 20–27 points and high well-being 28–35 points)<sup>24</sup> and percentage with a positive or negative meaningful change in well-being (of 1–3 points) were reported in accordance with Shah et al.<sup>25</sup> Cronbach's alpha values for each of the subscales of the questionnaire ranged from 0.83 to 0.85.<sup>22</sup>

Swimmers were asked two open-ended questions at the start of the course: to state their experience of outdoor swimming prior to the course and what their expectations of the course were. They were also asked two questions at the end of the course: what was it like to swim outdoors? And would they swim again, if so under what circumstances? These comments were grouped into themes.

## 2.4 | Statistical analysis

The data were analysed using SPSS v25 and checked for normality of distribution; non-normally distributed data were compared using non-parametric tests. Data are presented as mean (standard deviation [SD]) or *median (range)*. To explore the acute effect of the activity, paired samples *t*-tests or Wilcoxon signed rank tests were applied to POMS and SWEMWBS data collected before and after each session. To compare between sessions (the first pool session, the first sea swim and the final sea swim), repeated measures analysis of variance (ANOVA) was applied to POMS and Friedman's ANOVA to adjusted total SWEMWBS scores (chronic effect). Independent samples *t*-tests or Mann Whitney U tests were conducted to determine differences between swimmers and controls (between groups) for both POMS and SWEMWBS scores. Chi-squared tests also examined the relationship between group (swimmers and controls) and well-being level and change in well-being level calculated from adjusted total SWEMWBS scores.<sup>23</sup> Cramer's *V* was calculated to indicate the strength of the association (thresholds: 0.1 = small effect, 0.3 = moderate, and 0.5 = large effect). Effect size calculations were also performed; for normally distributed variables, Cohen's *D* was calculated (thresholds: 0.2 = small effect, 0.6 = moderate effect, 1.2 = large effect, and 2 = very large effect)<sup>26</sup>; and *r* was calculated for non-normally distributed variables (thresholds: 0.1 = small effect, 0.3 = moderate, and 0.5 = large effect).  $\alpha$  level was set at 0.05.

## 3 | RESULTS

### 3.1 | Attrition

Of the 64 swimming participants who entered the study (Figure 1), three withdrew from the programme after the pool swimming session and the remainder of missing data occurred due to non-attendance at sessions in which surveys were conducted. The complete data set consisted of 49 participants who returned questionnaires at each stage. This represented a 76.5% retention rate. Prior to the start of the study, all volunteers had no experience or exposure to swimming in cold sea water (water temperatures ranged from 15°C to 21°C). Twenty-two of the 24 non-swimming controls were retained (91%).

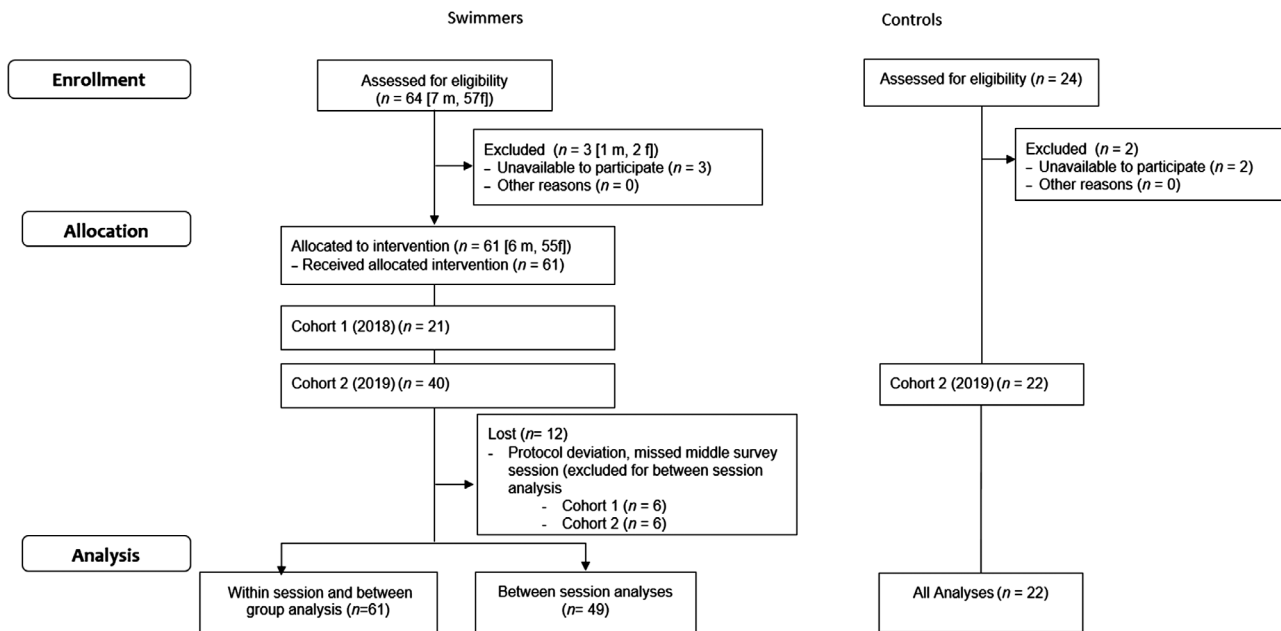
### 3.2 | Acute response (within session)

Table 1 shows the acute changes in POMS responses following the pool swim, the first and final sea swims. Significant increases in Esteem scores were found following each session (all sessions  $P < .001$ ,  $d = 0.6$ – $1.4$ ). Vigour increased following the pool and final sea swim ( $P = .011$ ,  $d = 0.5$  and  $P < .001$ ,  $d = 0.7$ , respectively). Reductions in Tension, Anger, Confusion and TMD were found following each session (Tension and TMD  $P < .001$ ,  $d = 0.4$ – $1.1$ , Anger and Confusion  $P < .001$ ,  $r = .4$ – $.6$ ). In addition, reductions in Depression scores were found following the pool and the final sea swims (pool  $P = .001$ ,  $d = 0.6$ , final sea swim

**TABLE 1** Mean (SD) or median (lower and upper quartile) and confidence interval of Profile of Mood states subscale scores in the swimmers (n = 61 or 49) and controls (n = 24 or 22) before and after the first pool session, the first sea swim and the final sea swim

Subscale	Swimmers				Controls							
	Before	After	Before - After difference	95% CI	P-value	Effect size	Before	After	Before - After difference	95% CI	P-value	Effect size
Pool swim (n = 61)												
Tension	5.1 (3.5)	1.1 (1.6)	4.0 (3.6)	3.1 to 4.9	<.001*	1.6	4.5 (2.4)	3.8 (2.0)	0.6	0.3 to 1.0	.002*	0.3
Anger	1.0 (1.8)	0 (0, 1)			<.001*	0.6	0.0 (0.0, 1.0)	1.0 (0.0, 3.0)			.083	0.4
Fatigue	5.9 (3.9)	6.9 (3.9)	-1.1 (5.7)	-2.6 to 0.3	.130	0.3	5.3 (2.8)	4.8 (2.5)	0.5	0.0 to 0.9	.046*	0.2
Depression	3.0 (4.0)	1.1 (2.2)	1.8 (4.1)	0.8 to 2.9	.001*	0.6	2.3 (4.1)	2.3 (4.4)	-0.4	-0.4 to 0.3	.802	0.0
Esteem	13.7 (2.9)	15.6 (3.4)	-1.8 (3.8)	-2.8 to -0.8	<.001*	0.6	12.7 (3.2)	12.3 (2.8)	0.5	0.1 to 0.8	.008*	0.1
Vigour	6.1 (4.6)	8.5 (5.0)	-2.3 (7.0)	-4.1 to -0.57	.011*	0.5	4.5 (3.4)	4.4 (3.4)	0.1	-0.9 to 0.3	.328	0.0
Confusion	3.0 (1.5)	1.0 (0.2)	12.9 (18.6)	8.1 to 17.7	<.001*	0.6	2.0 (0.0, 3.0)	2.5 (0.0, 3.0)	0.0	-1.0 to 1.0	.317	0.2
TMD	99.8 (15.6)	86.8 (9.1)			<.001*	1.1	98.3 (12.8)	98.3 (12.3)	0.0		>.999	0.0
1st Sea swim (n = 49)												
Tension	8.0 (3.9)	1.2 (1.7)	6.9 (4.1)	5.7 to 8.0	<.001*	2.4	7.5 (3.2)	4.7 (2.8)	2.8	2.1 to 3.5	<.001*	0.9
Anger	1.0 (0.2, 5)	0.0 (0, 1)			.001*	0.5	1.0 (0.0, 3.5)	1.0 (0.0, 3.0)			.066	0.4
Fatigue	4.6 (3.1)	5.2 (2.7)	-0.6 (4.3)	-1.8 to 0.6	.324	0.2	5.6 (2.8)	5.0 (2.5)	0.6	1.0 to 1.2	.023*	0.2
Depression	2.3 (3.4)	1.2 (1.8)	1.1 (4.1)	-0.1 to 2.3	.063	0.4	2.7 (3.0)	2.6 (2.8)	0.1	-0.2 to 0.3	.083	0.0
Esteem	12.5 (3.2)	15.8 (3.2)	-3.2 (4.2)	-4.4 to -2.0	<.001*	1.0	12.5 (3.3)	12.6 (3.1)	-0.5	-6 to 0.5	.866	0.0
Vigour	6.6 (3.7)	7.8 (2.8)	-1.1 (5.0)	-2.6 to 0.3	.108	0.4	4.7 (3.2)	4.4 (2.8)	0.2	-0.3 to 0.7	.348	0.1
Confusion	2.0 (1.5)	0.0 (0, 2.0)			<.001*	0.6	3.0 (1.0, 4.0)	3.0 (1.0, 4.0)			>.999	0.0
TMD	100.4 (14.1)	85.4 (9.6)	15.0 (18.5)	9.7 to 20.3	<.001*	1.3	103.9 (12.6)	100.2 (11.9)	3.7	3.0 to 4.5	<.001*	0.3
Final sea swim (n = 61)												
Tension	3.6 (2.1)	0.4 (0.8)	3.3 (2.2)	2.7 to 3.8	<.001*	2.2	6.7 (2.6)	6.5 (2.4)	0.3	-0.5 to 0.9	.488	0.1
Anger	0.0 (0.0, 2.0)	0.0 (0.0, 0.0)			.001*	0.4	2.0 (0.0, 3.0)	1.0 (0.0, 3.0)			.666	0.1
Fatigue	3.4 (2.7)	2.7 (2.4)	1.1 (3.2)	0.3 to 1.9	.009*	0.3	5.6 (2.9)	5.1 (2.6)	0.5	0.1 to 1.0	.045*	0.2
Depression	1.6 (2.2)	0.2 (0.7)	1.4 (2.2)	0.3 to 0.9	<.001*	1.0	2.7 (3.0)	2.5 (2.3)	0.3	-0.2 to 0.7	.229	0.1
Esteem	13.0 (2.7)	16.7 (2.6)	-3.6 (3.2)	-4.5 to -2.8	<.001*	1.4	12.5 (3.0)	11.9 (2.6)	0.7	0.2 to 1.3	.044*	0.2
Vigour	5.8 (3.0)	8.3 (4.1)	-2.5 (4.6)	-3.7 to -1.4	<.001*	0.7	4.7 (3.2)	4.9 (3.2)	-0.1	-0.6 to 0.4	.589	0.1
Confusion	3.0 (0.0, 5.0)	0.0 (0.0, 1.0)			<.001*	0.6	2.5 (1.0, 4.0)	2.5 (1.0, 4.0)			.792	0.1
TMD	93.9 (10.0)	79.0 (7.9)	14.9 (11.1)	12.1 to 17.8	<.001*	1.7	102.6 (12.1)	102.1 (10.7)	0.6	-0.9 to 1.9	.435	0.0

\*P < .05, Italics indicates median (lower and upper quartile).



**FIGURE 1** Participant flow through the study

$P < .001$ ,  $d = 1.0$ ). Interestingly, there were acute changes in subscales in the control group; these included: reduced Fatigue following all sessions (pool  $P = .045$ ,  $d = 0.2$ , first sea swim  $P = .023$ ,  $d = 0.2$  and final sea swim  $P = .045$ ,  $d = 0.2$ ) and reductions in Tension were found following the session in the pool and the first sea swim ( $P = .002$ ,  $d = 0.2$ ; first sea swim  $P < .001$ ,  $d = 0.9$ ).

### 3.3 | Chronic response (between session)

Between sessions comparisons for POMS and SWEMWBS subscale scores are shown in Tables 2 and 3. For both swimmers and controls, there was a significant increase in Tension before the first sea swim in comparison to the pool session (Swimmers,  $P < .001$ ,  $d = 0.8$ , control  $P = .002$ ,  $d = 1.0$ ). Subsequently reductions in Tension were found in the swimmers (before swimming in the pool and final sea swim  $P = .025$ ,  $d = 0.5$  and first vs final sea swim  $P < .001$ ,  $d = 1.5$  and after swimming in the pool and final sea swim  $P = .009$ ,  $d = 0.6$  and first and final sea swim  $P = .008$ ,  $d = 0.6$ ). In contrast, controls had a significant increase in Tension scores between the pool and final sea swim (before the swim sessions  $P = .003$ ,  $d = 0.9$ , after the swim session  $P < .001$ ,  $d = 1.1$ ) and between first and final sea swim ( $P < .001$ ,  $d = 0.07$ ). Following the swim sessions, significant reductions in Anger, Fatigue, Depression, Confusion and TMD were also seen in the swimmers between pool and final sea swim sessions (all between  $P < .001$  to  $P = .034$ ,  $d = 0.6$ – $1.1$ ) and between the first and final sea swims (all between  $P < .001$  to  $P = .012$ ,  $d = 0.7$ – $1.0$ ). These changes were not seen in the controls.

In swimmers, adjusted total SWEMWBS scores were significantly increased between the pool and final sea swim ( $P < .001$ ,  $r = .75$ ) and the first and final sea swim ( $P < .001$ ,  $r = .53$ ; Table 3). Whereas in

the control group, increases in adjusted SWEMWBS scores were found between the first and final sea swim ( $P = .019$ ,  $r = .43$ ); there was also a trend toward a reduction in adjusted SWEMWBS total scores between the pool and first sea swim ( $P = .053$ ,  $d = 0.34$ ). Finally, significant associations in well-being level change were found between the pool swim and the first sea swim ( $\chi^2_{(3)} = 13.148$ ,  $P = .004$ ,  $V = 0.393$ ) and between the pool and final sea swim ( $\chi^2_{(3)} = 54.791$ ,  $P < .001$ ,  $V = 0.803$ ), showing increased well-being level in greater numbers of swimmers than would be expected, but not controls.

### 3.4 | Swimmers versus controls (between group)

Table 4 shows POMS score comparisons between swimmers and controls. Subscale scores before the swims did not differ between swimmers and controls; however, before the final sea swim, the TMD was significantly lower in the swimmers compared to controls ( $P < .001$ ,  $d = 0.8$ ). In addition, following all swim sessions, significantly higher Vigour and Esteem scores were found in swimmers compared to controls (all  $P < .001$ ,  $d = 0.9$ – $1.8$  or  $r = .4$ ), and Tension, Anger, Depression, Confusion and TMD scores were significantly lower in swimmers compared to controls (all  $P < .001$  to  $P = .023$ ,  $d = 0.6$ – $3.8$  or  $r = .2$ – $.6$ ).

The adjusted total SWEMWBS scores (Table 5) indicate controls had significantly higher scores before the pool swim ( $P = .046$ ,  $r = .21$ ), whereas by the final sea swim, the swimmers had significantly higher adjusted total SWEMWBS scores than controls ( $P = .034$ ,  $r = .23$ ). At the final sea swim, the relationship between group (swimmers and controls) and the well-being level was significant ( $\chi^2_{(2)} = 7.428$ ,  $P = .029$ ); swimmers were more likely than controls to have moderate well-being values (Table 5). No other significant associations were found during the pool swim or the first sea swim.

**TABLE 2** Mean (SD) of Profile of Mood states subscale scores of swimmers and controls comparing the subscale values between the first pool session, the first sea swim and the final sea swim

Subscale	Swimmers (n = 49)				Controls (n = 22)				Swimmers (n = 49)				Controls (n = 22)					
	Before Swim	Mean	SD	P-value	ES	Mean	SD	P-value	ES	After swim	Mean	SD	P-value	ES	Mean	SD	P-value	ES
Tension	Pool	4.9	3.6	<.001a*	0.8	4.6	2.4	.002a*	1.0	Pool	1.2	1.8	.952a	0.0	4.0	2.0	.280a	0.3
	Firstsea	8.1	4.0	.025b*	0.5	7.5	3.3	.003b*	0.9	Firstsea	1.2	1.8	.009b*	0.6	4.7	2.8	<.001b*	1.1
	Final sea	3.5	2.2	<.001c*	1.5	6.7	2.6	.084c	0.2	Final sea	0.4	0.9	.008c*	0.6	6.5	2.4	<.001c*	0.7
Anger	Pool	2.3	2.9	.218a	0.3	1.3	2.1	.089a	0.3	Pool	0.5	0.8	.508a	0.1	1.6	2.00	.673a	0.1
	Firstsea	1.7	1.8	.009b*	0.5	2.1	2.5	.040b*	0.4	Firstsea	0.6	0.9	.034b*	0.6	1.7	1.90	.247b	0.2
	Final sea	1.0	1.8	.024c*	0.4	2.1	2.1	.892c	0.0	Final sea	0.1	0.6	.012c*	0.7	2.0	2.30	.444c	0.1
Fatigue	Pool	5.8	4.1	.100a	0.3	5.2	2.9	.592a	0.1	Pool	6.9	4.1	.019a*	0.5	4.7	2.5	.686a	0.1
	Firstsea	4.6	3.2	.005b*	0.5	5.6	2.8	.683b	0.1	Firstsea	5.2	2.7	<.001b*	1.3	5.0	2.5	.642b	0.2
	Final sea	4.0	2.9	.184c	0.2	5.6	2.9	.892c	0.0	Final sea	2.6	2.3	<.001c*	1.0	5.1	2.6	.812c	0.0
Depression	Pool	3.2	4.1	.211a	0.2	2.4	4.2	.532a	0.1	Pool	0.9	1.9	.505a	0.2	2.4	4.6	.670a	0.1
	Firstsea	2.3	3.4	.014b*	0.5	2.8	3.0	.628b	0.1	Firstsea	1.2	1.8	.016b*	0.5	2.6	2.9	.912b	0.0
	Final sea	1.5	2.2	.076c	0.3	2.7	3.0	.771c	0.0	Final sea	0.2	0.8	.001c*	0.8	2.4	2.3	.427c	0.1
Esteem	Pool	14.1	2.7	.006a*	0.5	12.8	3.2	.732a	0.1	Pool	15.9	3.5	.877a	0.0	12.4	2.9	.798a	0.1
	Firstsea	12.6	3.2	.065b	0.4	12.5	3.3	.754b	0.1	Firstsea	15.8	3.2	.133b	0.3	12.6	3.1	.410b	0.2
	Final sea	13.1	2.6	.234c	0.2	12.6	3.0	.888c	0.0	Final sea	16.8	2.7	.103c	0.3	11.9	2.6	.135c	0.2
Vigour	Pool	6.6	4.7	1.000a	0.0	4.7	3.5	.946a	0.0	Pool	8.2	5.4	.646a	0.1	4.6	3.4	.786a	0.1
	Firstsea	6.6	3.7	.200b	0.3	4.6	3.2	.953b	0.0	Firstsea	7.8	2.8	.674b	0.1	4.4	2.8	.718b	0.1
	Final sea	5.6	2.8	.135c	0.3	4.7	3.2	.855c	0.0	Final sea	8.5	4.1	.271c	0.2	4.9	3.2	.329c	0.2
Confusion	Pool	3.4	2.6	.290a	0.2	2.2	2.1	.073a	0.4	Pool	1.4	1.3	.016a*	0.5	2.5	2.2	.238a	0.3
	Firstsea	2.9	2.4	.023b*	0.5	3.1	2.5	.179b	0.3	Firstsea	0.8	1.1	<.001b*	0.9	3.1	2.5	.511b	0.2
	Final sea	2.1	2.4	.096c	0.3	2.8	2.4	.186c	0.1	Final sea	0.5	0.8	.068c	0.3	2.8	2.3	.259c	0.1
TMD	Pool	99.0	16.5	.606a	0.1	98.2	13.4	.018a*	0.4	Pool	86.9	9.4	.480a	0.2	98.1	12.8	.334a	0.2
	Firstsea	100.4	14.0	.058b	0.4	103.9	12.6	.098b	0.3	Firstsea	85.4	9.7	<.001b*	1.0	100.2	11.9	.083b	0.3
	Final sea	93.4	10.1	<.001c*	0.6	102.6	12.1	.189c	0.1	Final sea	78.6	8.0	<.001c*	0.8	102.1	10.7	.064c	0.2

Abbreviations: ES, effect size; a, pool swim versus first sea swim; b, pool swim versus final sea swim; c, first sea swim versus final sea swim.

\*P &lt; .005.

**TABLE 3** Mean (SD) or median (lower and upper quartile) of SWEMWBS subscale scores comparing swimmers and controls for the first pool session, the first sea swim and the final sea swim

	Swimmers (n = 49)			Control (n = 22)		
	Pool	First sea swim	Final sea swim	Pool	First sea swim	Final sea swim
Median	20.0	20.7	25.0	20.7	19.3	21.9
Range	16.4–26	15.3–26	16.4–27	16.9–25	16.9–26	16.9–25
Change from pool	–0.373a	<0.001b*	<0.001c*	0.053a	0.192b	0.019c*
Effect size (r)		.04	.75		.34	.19
Change between first and final sea swim	4.3			1.6		
Effect size (r)			.53			.43
	Pool to first sea swim	Pool to final sea swim	First to final sea swim	Pool to first sea swim	Pool to final sea swim	First to final sea swim
Meaningful positive change (n)	11y	39z	34	5y	6z	12
Meaningful negative change (n)	8	5	7	11	2	3
Meaningful positive change (%)	22	64	69	23	27	55
Meaningful negative change (%)	16	8	14	50	9	14

a, pool versus first sea swim; b, pool versus final sea swim; c, first versus final sea swim.

\* $P < .05$ ; y = difference between swimmers and controls  $P = .004$ ; z = difference between swimmers and controls  $P < .001$ .

### 3.5 | Narrative

Upon completion of the course, volunteers were free to comment on their experiences, stating they found sea swimming challenging to begin 'it was tough to start with', 'weirdly claustrophobic to begin with' or 'tiring and hard work' and all stating they would continue to sea swim following the course as they found the swimming 'invigorating', 'enjoyable', 'confidence building' or 'life affirming'. With several noting their state of mind when sea swimming, 'the head space was amazing, 'it is so peaceful' and 'there is a sense of freedom and oneness even within a group that I found really therapeutic and uplifting'. Others noted the sociable inclusive atmosphere, 'the people were great' and 'I enjoyed the company of others whilst swimming unlike pool swimming which can get too cramped when others are in the same lane.' All commented that they would continue to swim outdoors following the course.

Control volunteers indicated their nervousness and anxieties 'I felt nervous each time..... went in the water, I always felt better when she was out and had rewarmed' or 'It was hard watching them swim as you felt a little powerless. If they got into trouble I wouldn't have been able to help. But they were in good hands and it was lovely to watch the improvement in them all, but I still felt nervous before each swim'.

## 4 | DISCUSSION

This study tracked the changes in mood and well-being during a progressive, introductory pool and sea swimming programme in novice sea swimmers and a group of controls. It was demonstrated

in swimmers that there was an acute reduction in negative mood states (tension, fatigue, depression, anger and confusion) and increase in positive mood (esteem-related affect and vigour) during the pool and outdoor swimming sessions. Furthermore, over the course of the 10-week programme, a chronic reduction in negative mood was found in the swimmers, whereas positive mood remained at moderate to high levels. There were also increased well-being scores in swimmers particularly during the sea swimming phase of the study. In addition, acute and chronic changes in single mood states and overall well-being were also observed in the controls, but fewer subscales changed and the magnitude of change was much smaller compared to swimmers. This suggests there are acute as well as longer term changes in mood and well-being as a consequence of participation in an outdoor swimming programme, and the hypothesis is accepted.

This study shows pool and outdoor swimming acutely reduces negative and increases positive mood; it also provides evidence of a longer term reduction in negative mood between progressive sea swimming sessions, and in comparison to a control group who were inactive on the beach. The results of this study are consistent with the changes in mood states observed when performing cross-sectional studies of winter swimmers.<sup>20</sup> Unlike Huttentten et al's study<sup>20</sup> who recruited experienced winter swimmers, the participant groups in the present study were chosen as they had little or no previous experience of swimming outdoors, hence the reason for the high tension scores prior to the first outdoor swim. The high tension subscale scores are understandable, when preparing for a new activity they have not attempted before, and were reflected in narrative comments swimmers made about their

**TABLE 4** Mean (SD) or median (lower and upper quartile) of Profile of Mood states subscale scores of swimmers and controls before and after the first pool session, the first sea swim and the final sea swim

Subscale	Swimmers	Controls	Mean difference	95% CI	P-value	Effect size
Pool session	(n = 61)	(n = 22)				
Tension before	6.0 (1.0, 8.0)	5.5 (2.0, 6.0)			.200	0.1
Tension after	1.0 (0.0, 1.0)	5.0 (1.0, 6.0)			<.001*	0.6
Anger before	1.0 (0.0, 3.5)	0.0 (0.0, 1.0)			.088	0.2
Anger after	0.0 (0.0, 1.0)	1.0 (0.0, 3.0)			.011*	0.3
Fatigue before	5.9 (3.9)	5.3 (2.8)	0.6	-1.1 to 2.3	.487	0.2
Fatigue after	7.0 (3.9)	4.8 (2.5)	2.2	0.5 to 3.9	.013*	0.7
Depression before	1.0 (0.0, 5.0)	1.0 (0.0, 2.0)			.546	0.1
Depression after	0.0 (0.0, 1.0)	1.0 (0.0, 2.0)			.023*	0.2
Esteem before	13.8 (2.9)	12.7 (3.2)	1.1	-0.4 to 2.5	.141	0.4
Esteem after	15.6 (3.5)	12.3 (2.8)	3.4	1.8 to 5.0	<.001*	1.0
Vigour before	5.0 (3.0, 9.0)	3.0 (2.0, 8.0)			.125	0.2
Vigour after	9.0 (4.0, 12.0)	3.0 (2.0, 7.0)			<.001*	0.4
Confusion before	3.0 (1.0, 5.0)	2.0 (0.0, 3.0)			.064	0.2
Confusion after	1.0 (0.0, 2.0)	2.5 (0.0, 3.0)			.021*	0.3
TMD before	99.8 (15.8)	98.3 (12.9)	1.5	-5.7 to 8.7	.677	0.1
TMD after	87.0 (83.0, 92.0)	95 (92.0, 103.0)			<.001*	0.5
First sea swim	(n = 49)	(n = 22)				
Tension before	8.1 (4.0)	7.5 (3.3)	0.6	-1.3 to 2.5	.533	0.2
Tension after	1.2 (1.7)	4.7 (2.8)	-3.5	-4.8 to -2.2	<.001*	1.6
Anger before	1.0 (0.0, 2.5)	1.0 (0.0, 3.0)			.838	0.0
Anger after	0.0 (0.0, 1.0)	1.0 (0.0, 3.0)			.004*	0.3
Fatigue before	4.6 (3.2)	5.6 (2.8)	-1.0	-2.6 to 0.6	.197	0.3
Fatigue after	6.0 (3.0, 7.0)	4.5 (3.0, 7.0)			.754	0.0
Depression before	2.3 (3.5)	2.8 (3.0)	-0.4	-2.2 to 1.2	.586	0.2
Depression after	1.2 (1.8)	2.6 (2.8)	-1.4	-2.6 to -0.3	.011*	0.6
Esteem before	12.0 (10.0, 15.5)	12.0 (10.0, 15.0)			.965	0.0
Esteem after	15.8 (3.2)	12.5 (3.1)	3.2	1.6 to 4.9	<.001*	1.0
Vigour before	6.6 (3.7)	4.6 (3.2)	2.0	0.2 to 3.8	.034*	0.6
Vigour after	7.8 (2.8)	4.4 (2.8)	3.4	2.0 to 4.8	<.001*	1.2
Confusion before	2.0 (1.0, 5.0)	3.0 (1.0, 4.0)			.725	0.1
Confusion after	0.0 (0.0, 2.0)	3.0 (1.0, 4.0)			<.001*	0.4
TMD before	100.4 (14.1)	103.9 (12.6)	-3.5	-10.5 to 3.5	.324	0.3
TMD after	85.4 (9.7)	100.2 (11.9)	-14.8	-20.1 to -9.4	<.001*	1.4
Final sea swim	(n = 61)	(n = 22)				
Tension before	3.6 (2.1)	6.7 (2.6)	-3.1	-4.2 to -2.0	.586	1.3
Tension after	0.4 (0.8)	6.5 (2.4)	-6.1	-7.2 to -5.1	<.001*	3.8
Anger before	0.0 (0.0, 2.0)	2.0 (0.0, 3.0)			.014*	0.3
Anger after	0.0 (0.0, 0.0)	1.0 (0.0, 3.0)			<.001*	0.6
Fatigue before	3.8 (2.7)	5.6 (2.9)	-1.8	-3.1 to -0.4	.430	0.6
Fatigue after	3.0 (0.0, 4.0)	5.5 (2.5, 7.0)			.001*	0.4
Depression before	1.6 (2.2)	2.7 (3.0)	-1.1	-2.3 to 0.1	.237	0.4
Depression after	0.2 (0.7)	2.5 (2.3)	-2.2	-3.3 to -1.2	<.001*	1.6

(Continues)



**TABLE 4** (Continued)

Subscale	Swimmers	Controls	Mean difference	95% CI	P-value	Effect size
Esteem before	13.0 (2.7)	12.6 (3.0)	0.5	−0.9 to 1.8	.475	0.1
Esteem after	16.7 (2.6)	11.9 (2.6)	4.8	3.5 to 6.1	<.001*	1.8
Vigour before	5.8 (3.0)	4.7 (3.2)	1.0	−0.5 to 2.5	.181	0.4
Vigour after	8.3 (4.1)	4.9 (3.3)	3.4	1.5 to 5.4	.001*	0.9
Confusion before	3.0 (0.0, 5.0)	2.5 (0.0, 4.0)			.432	0.1
Confusion after	0.0 (0.0, 1.0)	2.5 (1.0, 4.5)			<.001*	0.6
TMD before	93.9 (10.0)	102.6 (12.1)	−8.7	−13.9 to −3.4	<.001*	0.8
TMD after	79.0 (7.9)	102.1 (10.7)	−23.01	−27.4 to −18.8	<.001*	2.5

\* $P < .05$ , Italics indicates median (lower and upper quartile).

**TABLE 5** Mean (SD) of SWEMWBS subscale scores of swimmers and controls comparing the subscale values between the first pool session, the first sea swim and the final sea swim

	Pool		First sea swim		Final sea swim	
	Swimmers	Control	Swimmers	Control	Swimmers	Control
	61	24	49	22	61	22
Median	20	20.7	21	19.3	26	21.9
Range	16.4–26.0	16.9–25	15.3–26.0	16.9–26	16.4–27.0	16.9–25
	0.046*		0.554		0.034*	
Effect size (r)	.21		.06		.23	
% Low well-being	59	38	47	59	13	27
% Moderate well-being	41	63	53	41	87+	73+
% High well-being	0	0	0	0	0	0

\* $P < .05$ , +Association between group and well-being level ( $P = .029$ ).

first experience. However, significantly reduced negative mood state scores are evident both before and after the final sea swim, which suggests the POMS subscales triangulate well with the bold narrative comments.

The sample of swimmers and controls in the present study had low to moderate well-being values<sup>24</sup> and were within the 10th to 90th percentile range for population norm referenced values.<sup>27</sup> Therefore, these data reflect a broad spectrum of the population in terms of well-being and possibly mental health. The well-being scores of controls decreased between the pool and the first sea swim and increased again by the final sea swim, maintaining well-being from start to finish. In contrast, swimmers well-being scores increased at each stage, especially between the sea swimming sessions. However, this study can offer no mechanistic insight and these changes may have occurred due to a range of possibilities (physiological, psychological, and sociological) either as single factors or more likely a combination of factors.

The responses of the controls are also of interest. This group includes friends or family of the swimmers, observing their activities from the viewing gallery at the pool and from the beaches during sea

swims. Compared to the pool session, the controls overall TMD was similar and total SWEMWBS score increased. However, these improvements in mood and well-being were not as large as those observed in the swimmers. The fact the controls were on the beach may have reduced negative mood states. There is evidence that proximity to water, whether you are entering the water or not, or visiting 'blue space' contributes to improved mental health.<sup>28,29</sup> In addition, before the first sea swim, the controls also experienced the same increase in tension as the swimmers. The controls were supporting the swimmers in a challenging activity, which may not initially appear to be that rewarding, but ultimately it was for the swimmers. The tension initially felt by swimmers may have been transmitted to their friends/family (acting as controls) whose tension levels appear elevated in comparison to the pool swimming session. Reflecting on the narrative comments, it may be that controls experienced vicarious emotion or empathy and projected their thoughts and feelings on to the swimmers positions.<sup>30</sup>

The narrative accounts recorded after the course indicated the swimmers enjoyed their outdoor swimming experience. These accounts agree with previous observations that outdoor swimming

offers a change in personal focus and has a calming influence,<sup>11,19</sup> and all would continue to participate in outdoor swimming. This is encouraging as the problem with many interventions is that participation rapidly declines over time. Although the study provides no mechanisms for the changes in mood or well-being, swimmers explained the positive effects of performing an exercise they came to enjoy. This included being in cold water, in an outdoor space with few people around, provided an opportunity for mastery, goal achievement, confidence building, challenge and a sociable environment with like-minded people. These explanations have been suggested previously for other forms of leisure activity<sup>31</sup> or exercise taken outdoors<sup>7,9,17,18</sup> as well as outdoor swimming.<sup>11</sup> It may also be that a number of these factors are interlinked. Previous research indicates that physical activity in natural environments is associated with a reduced risk of mental ill health,<sup>9</sup> and further to that, may have a positive therapeutic effect.<sup>17,18</sup> Considering a recent case study,<sup>11</sup> it seems pertinent to establish if outdoor swimming has any benefits to support improvements to mental health. Therefore, it would be of interest to determine how outdoor swimming and continued participation may affect people living with a clinically diagnosed mood disorder or depression.

Indoor and outdoor swimming are not alone in the acute and chronic effects on mood and well-being. Many forms of exercise appear to result in similar effects including treadmill running<sup>32</sup> and running outdoors.<sup>33</sup> Therefore, the potential benefits of outdoor swimming for improved mental health do warrant further enquiry. This is an activity that involves risk. Therefore, future studies should look to include terrestrial activities, as control groups, which may be more easily achieved and conducted more safely to establish if similar effects can be found. These control groups could include cohorts that are active and sedentary in outdoor built and natural settings, and possibly cohorts who are active and sedentary indoors. By including these cohorts, we may start to tease out the separate effects of mode of activity or inactivity and the environment and which combinations are most and least effective in improving mood and well-being. However, this study does seem to add to the evidence that there is no one size fits all approach to improving mood, well-being and mental health.<sup>34</sup> Therefore, having a choice of activities and provision of qualified and experienced support (in the case of open water swimming, trained coaches and lifeguards) is key.

The study is not without limitation. The first pool swim and first sea swim were 3 weeks apart and formed the start of the course; therefore, new group dynamics, unfamiliarity and participation in a new and challenging activity may have impacted on well-being and were evident in the elevated POMS Tension scores of swimmers and controls before the first sea swim. The comparison between the first and final sea swims was 6 weeks apart and formed the later longer part of the course. Therefore, the short time frame (3 weeks) between the first two assessments (first pool swim and first sea swim) may be too short for changes in well-being to be observed. Further to this, the Cronbach alpha value for the POMS scale suggested low internal consistency for the depression subscale (0.664). Despite the lower internal consistency, significant reductions were found in the depression subscale.

The shorter POMS form was used in this instance to maximize response rate as time at the start and end of each session was short. Using longer versions with greater internal consistency may have reduced the problem, but may have reduced the response rate, due to the increased completion time. In addition, although it would be preferable to recruit an equal number of male and female volunteers, this was not possible as the majority of the customers attending the courses were female. Gender comparison studies have been performed with mixed results, some indicating no or minimal differences in mood state between males and females,<sup>35,36</sup> and others have found some indices to be elevated in females.<sup>37</sup> Furthermore, the nature of the convenience sampling method is a weakness as there was no randomisation to the study, but is a starting point from which stronger randomised control trials (RCTs) can build upon. In the present study, swimmers were paying for 10 coached sessions in an activity they expressed an interest in doing, thus they were motivated to attend the sessions. However, retention in RCT may be lower than that in the present survey, due to the participants being allocated randomly to either the intervention or the control, which may not provide them with the experience they would like to achieve. This may be reduced by a crossover design, or by offering control participants the opportunity to undertake the intervention after completion of the follow up. Recruitment of a similar-sized sample of controls would provide a stronger design; however, far fewer controls were available. Finally, this initial study design would have been greatly improved by the use of a follow up survey, and the problem with so many interventions being that people's participation rapidly declines. Therefore, follow-up will be undertaken in subsequent intervention studies to be performed. From participants' comments, it appears that the majority of those surveyed wished to continue outdoor swimming once the course had been completed either through formally joining clubs or meeting up with friends they made on the course. Consequently, the course provided them with skills, knowledge and contacts to potentially continue the activity upon the completion of the course.

In conclusion, novice outdoor swimmers had acute and chronic reductions in negative mood, increases in well-being and acute increases in positive mood. Controls' mood scores fluctuated and were similar at the start and end of the course, whereas well-being scores improved by the final session. Furthermore, tension scores peaked immediately in both swimmers and controls before the first outdoor swimming session. Nonetheless the swimmers improvement in mood and well-being scores were significantly greater than the controls. Therefore, the hypothesis stating that there would be acute as well as longer term changes in mood and well-being as a consequence of participation in an outdoor swimming programme is accepted. The nature of this study does not provide mechanistic understanding; there are likely to be a number of explanations for the changes in mood and well-being in swimmers and controls that can be investigated in the future.

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## CONFLICT OF INTEREST

The authors declare no conflict of interest.

## AUTHOR CONTRIBUTIONS

HM, CD, MH, PG, and HD contributed to the design and implementation of the research. HM, NK, and PG to the analysis of the results. HM drafted the first manuscript. All authors contributed to improving and finalising the manuscript.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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