

Are there fitness-related physiological changes following a series of Rebirthing sessions?

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ABSTRACT

Objective: The current study is only the second known empirical study of Rebirthing, a holistic self-improvement therapy. The study looked at fitness-related physiological outcomes following a series of rebirthing sessions.

Methods and materials: Ten healthy young women (mean age, weight, and height: 372.7 years, 54.16.4 kg, and 161.24.9 cm, respectively) underwent two identical resting pulmonary function tests (PFTs) and two two-stage all-out graded cardiopulmonary exercise tests (CPETs) before (pre) and after (post) a series of 10 weekly Rebirthing treatments. The rebirthing sessions were held at the Israeli Rebirthing Center in Tel Aviv. All rebirthing treatments were performed by a single qualified Rebirthing therapist and lasted approximately 40-50 minutes each.

Results: There were no significant changes ($p > 0.05$) in resting lung functions (PFTpost) or peak values at maximal effort (CPETpost) after the rebirthing program (except for a decrease in HRpeak). Nonetheless, the results show a significant reduction ($p < 0.05$) in several cardiopulmonary attributes measured during the submaximal phase of the second CPET (HRsub, VO₂sub, RERsub, Vesub, BRsub; Bfsub and an increase in Vd/Vtsub).

Conclusions: As the first study to investigate the effect of a series of rebirthing treatments on responses of selected fitness-related physiological measures at rest and during exercise, it is not surprising that no unambiguous answers to the research questions were found. Further studies are needed to provide reliable support and explanations for the study findings.

Keywords: Rebirthing therapy, voluntary hyperventilation, exercise, habituation, PFT, CPET, MRT

INTRODUCTION

Voluntary hyperventilation has recently been used in clinical psychology and psychiatry to induce panic for diagnostic purposes and as part of anxiety disorder desensitization therapies (1, 2). Rebirthing (also known as Breastwork, Conscious Breathing, Circular Breathing, and Connected Breathing), which reproduces over-breathing or hyperventilation, is a holistic self-improvement therapy that has received substantial interest and numerous clients since its development in 1975 by Leonard Orr (3, 4).

Millions of rebirthing advocates worldwide claim that rebirthing treatment helps overcome physical and mental difficulties and improves overall well-being. The primary rationale for these positive effects of rebirthing therapy is based on the claim that an intense breathing process (hyperventilation) can improve concentration and sleep quality, combat fatigue, and increase energy (5, 6, 7).

Although millions of people worldwide have been successfully Rebirthing (8), no controlled scientific research has empirically studied the reported effects. One major benefit of Rebirthing claimed by leaders in the field is that rebirthed people can use their positive thoughts and full breathing to eliminate unwanted emotional and physical symptoms. More specific claims include improving and curing mood, increasing lung capacity, improving physical fitness, curing various respiratory problems, increasing energy levels during the day, curing migraines and headaches, relieving and curing chronic pain in various parts of the body, improving concentration, and improving learning ability (5, 9, 3, 10, 11).

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Since, to the best of our knowledge, only one scientific/empirical study (12) has examined the validity of those largely subjective reports on healthy adults, the purpose of the current study was to investigate some of the aforementioned claims regarding pulmonary functions and physical fitness in an objective manner.

It is generally accepted that under healthy normal conditions, the respiratory system is not a limiting factor in aerobic capacity (VO_2max) or performance unless at very high-intensity levels (13, 14, 15).

Thus, even specific respiratory muscle training (RMT) that improves respiratory muscle strength and endurance at rest (16, 17) is not expected to increase aerobic or exercise capacity (18, 19). Therefore, even if we consider the rebirthing session series used in the present study to be a type of RMT, thereby significantly improving resting lung function, it is not expected to strengthen participants' aerobic capacity/performance noticeably.

When we proposed the overall Rebirthing project, we sought to answer the following key questions:

1. What physiological changes occur during a single rebirthing session (already published (12)?
2. Are there any physiological changes related to physical fitness after a series of rebirthing sessions?
3. Are there physical, emotional, or mental changes after a series of rebirthing sessions?

This report addresses only the second question of the project, i.e., "Are there any fitness-related physiological changes that occur after a series of rebirthing sessions?"

We hypothesized that a series of rebirthing sessions would result in a significant improvement in resting lung function. We also hypothesized that the sequence of rebirthing sessions would not significantly increase physical fitness attributes such as aerobic power and performance.

MATERIAL and METHODS

Participants: Participants were recruited from a pool of potential clients. Eleven healthy young women were selected from potential clients in central Israel. Their mean age, weight, and height were 37 ± 2.7 years, 54.1 ± 6.4 kg, and 161.2 ± 4.9 cm, respectively.

All participants were medically examined (including resting and exercise ECG), found healthy, and did not take any medications (except birth control pills). Participants were instructed to eat a regular diet, not to consume caffeine or alcohol the day before testing, and not to engage in vigorous exercise for 24 hours before the experiment.

The Helsinki Committee for the Protection of Human Subjects (Institutional Review Board) at Kaplan Medical Center in Rehovot, Israel, approved all study protocols and procedures.

Participants were fully informed of the procedures, risks, and inconveniences of study participation, and all gave their signed informed consent to participate. Participants were informed that they might withdraw from the study at any time and for any reason.

Of the eleven "starters," only one participant withdrew from the study (because of early pregnancy).

Study design and procedures

Preliminary visit: The preliminary measurements for this study were performed at the Human Performance Laboratory at Washington Hill College in Israel.

At the initial visit, participants received a detailed explanation of the study objectives and procedures and signed an informed consent form. Participants provided information on their medical history and exercise habits. Weight and height were measured to the nearest 0.02 kg and 0.1 cm, respectively, using a model H151-8 Shekel scale (Shekel Scales Ltd., Beit Keshet, Israel), while participants were barefoot and wearing light athletic clothing.

Following the preliminary visit, two additional visits to the laboratory were made three months apart (before and after a ten rebirthing sessions), during which a resting pulmonary function test (PFT) and a cardiopulmonary exercise test (CPET) were performed.

The pulmonary function test (PFT): For this test, the subject was set upright in front of a spirometry machine [the K4b2 portable metabolic system (Cosmed, Rome, Italy)] attached to a plastic mouthpiece and wearing a nose clip. She was asked to take a deep breath in, then exhale as forcefully and quickly as possible until she emptied her lungs. She was then allowed to breathe normally before repeating the test twice.

The exercise tests: Two-stage incremental cardiopulmonary exercise tests to voluntary exhaustion (CPETs) were carried out, and measurements of some 14 physiological variables were obtained. The exercise tests (CPETs) were performed on a motorized treadmill (Ram 770CE, Germany). The exercise protocol began with the subject walking on the level at 3 km/h for 2 min. This was followed by work rate increments of 1 km/h each minute until the participant reached a work rate (speed) eliciting 70-75% of her age-predicted maximal HR. This work rate was kept constant for 5-6 min to secure steady-state conditions (verified by unchanged HR and VO_2 for at least two consecutive minutes). Immediately following this stable work-rate stage, work-rate increments of 2% inclination were imposed each minute (with speed being maintained) until the patient reached her tolerance limit (typical total CPET time was 13-17 min) (19, 20). An attempt was made to ensure that each participant gave maximal effort by providing continuous verbal encouragement and support based on age-predicted maximal HR, $\text{RER} > 1.15$, and falling of ETCO_2 during the last 3 minutes of the test (by $> 3-4$ mmHg). Continuous 12-lead ECG was monitored throughout the tests, with recordings made at baseline and the end of each minute of exercise, and during the recovery period (see Figure 1).

Gas exchange was measured continuously during the exercise tests, namely oxygen uptake (VO_2), carbon dioxide production (VCO_2), and minute ventilation (VE) using the K4b2 portable metabolic system (Cosmed, Rome, Italy). The pneumotachograph and analyzers of the K4b2 were calibrated before each test session according to the manufacturer's specifications.

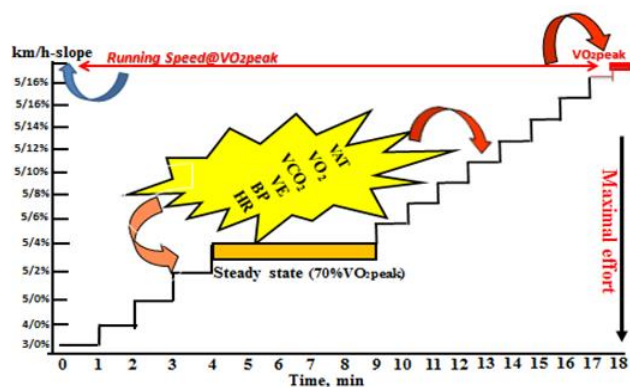


Figure 1: Schema of exercise protocol

Peak cardiopulmonary values were obtained as the highest 30-second average during the last minute of the test. Submaximal values were calculated by taking a one-minute average of the fifth minute of the constant workload (submaximal stage).

The second (post) PFT and CPET were performed under identical conditions (environmental and protocol) by all study participants shortly (2-3 days) after the last (10th) rebirthing session).

The Rebirthing sessions

Location: Rebirthing sessions took place at the Israeli Rebirthing Center in Tel Aviv. All treatments were conducted by a single qualified rebirthing therapist who has experienced thousands of rebirthing sessions over the past 15 years.

The sessions took place in a dark, quiet room and were conducted in a one-to-one situation (see picture) with the same trained therapist for all participants. Participants were asked to remove their shoes and coats and lie supine on a mattress with a blanket to warm and soothe them. The therapist instructed participants to begin connected breathing and increase it to a full, forceful, and steady rhythm, drawing high on the inhale and releasing freely on the exhale.



Image 1: The Rebirthing session's set-up

The sessions lasted about 50 minutes. When a participant showed signs of difficulty in breathing or drowsiness, the therapist recognized it and guided the participant accordingly. At the end of the rebirthing sessions, the therapist gently escorted the client back to the clinic waiting room.

Measurements taken during the rebirthing sessions

Selected physiological (cardiopulmonary) measurements were taken breath-by-breath using the same portable metabolic system (COSMED K4b₂, Rome, Italy) used during the CPETs and the rebirthing sessions.

RESULTS

The following tables compare the data of selected physiological parameters measured before (pre) and after (post) the rebirthing treatment series

Table 1 compares the results of lung functions at rest obtained before and after the ten weekly rebirthing sessions. The data show statistical equality ($p > 0.05$) in all spirometric indices between pre- and post-sessions. Thus, we conclude that the present rebirthing sessions did not affect the study participants' resting pulmonary functions (refuting the first study's assumption).

Table 1: Pulmonary function test's variables before and after the Rebirthing treatments.

	FVC, liter		FEV1, l/sec		FEV1/FVC, %		PEF, l/sec		MEF25- 75 %, l/sec	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Mean	3.65	3.62	3.07	3.06	84.3	84.7	7.05	7.25	3.53	3.65
SD	0.035	0.33	0.26	0.25	4.67	4.52	0.55	1.05	0.81	0.90
t	- 0.25		-0.12		0.14		0.69		0.40	
P	0.40		0.45		0.45		0.26		0.35	

FVC - Forced vital capacity; FEV1 – Forced expiratory volume in 1 second; FEV1/FVC,% - The ratio between FEV1 to FVC; PEF – Peak expiratory flow rate; MEF25- 75 % - Mid expiratory flow rate.

The effect of rebirthing treatments on selected physiological responses during submaximal aerobic exercise.

Table 2 shows a significant decrease ($p < 0.05$) of $\text{VO}_{2\text{sub}}$, RER_{sub} , HR_{sub} , VE_{sub} , BR_{sub} , Bf_{sub} , $\text{VE}/\text{VCO}_{2\text{sub}}$, and an increased $\text{Vd}/\text{Vt}_{\text{sub}}$. A decrease in the above attributes suggests more economical and less demanding cardiopulmonary responses to a similar mechano-metabolic load after the rebirthing treatment regimen. There were no significant differences in the remaining cardiopulmonary attributes between the pre and post-rebirthing regimen.

The effect of rebirthing treatments on selected physiological responses during maximal aerobic exercise.

Table 3 compares selected physiological data measured during a maximal graded aerobic effort before (Pre) and after the last rebirthing session (Post). A look at Table 3 shows that of the fourteen (14) cardiopulmonary variables measured during the maximal graded aerobic effort, only peak pulse rate (HR) was significantly affected (decreased) after the rebirthing treatments. All other thirteen peak cardiopulmonary attributes did not change following the rebirthing program (supporting our 2nd hypothesis). These findings suggest no improvement in the participants' aerobic capacity (peak VO_2) or aerobic performance (peak workload).

Table 2: compares responses of selected physiological attributes measured while performing a submaximal effort before and after a series of Rebirthing sessions.

Variable	Mean ($\pm 1\text{SD}$)			
	Pre	Post	t	p
Work load _{sub} , kmh/%	5.7/8.1 (0.5/1.4)	5.7/8.1 (0.5/1.4)	0.00	1.00
$\text{VO}_{2\text{sub}}$, ml/kg/min	20.6 (2.77)	19.17 (2.97)	4.10	0.00
RER_{sub} , L/L	0.97 (0.07)	0.92 (0.09)	1.92	0.05
HR_{sub} , b/min	140.15 (12.94)	131.5 (9.27)	1.91	0.05
$\text{O}_2\text{pulse}_{\text{sub}}$, ml/kg/beat x100	14.72 (1.82)	14.64 (2.1)	0.96	0.47
VE_{sub} , l/min	32.37 (5.65)	30.42 (5.42)	2.99	0.01
Vt_{sub} , L	1.17 (0.24)	1.19 (0.27)	-0.28	0.39
Bf_{sub} , b/min	28.42 (3.04)	26.55 (4.32)	2.13	0.004
BR_{sub} , %	27.55 (4.55)	26.32 (4.97)	1.97	0.03
$\text{VE}/\text{VO}_{2\text{sub}}$, L/L	28.13 (1.65)	28.11 (1.62)	0.05	0.48
$\text{VE}/\text{VCO}_{2\text{sub}}$, L/L	29.18 (1.54)	30.77 (1.56)	-2.28	0.03
$\text{PETO}_{2\text{sub}}$, mmHg	106.91 (2.55)	105.63 (2.74)	1.44	0.09
$\text{PETCO}_{2\text{sub}}$, mmHg	39.24 (2.35)	37.66 (2.06)	1.51	0.08
$\text{Vd}/\text{Vt}_{\text{sub}}$, %	33.73 (0.61)	35.02 (1.25)	-4.61	0.00

Workload_{sub} – Mechanical power in treadmill's speed (km/hr) and slope (%); $\text{VO}_2/\text{kg}_{\text{sub}}$ – Oxygen uptake per kg; RER_{sub} – Respiratory exchange ratio; HR_{sub} – Heart rate; $\text{O}_2\text{pulse}_{\text{sub}}$ – Oxygen pulse; VE_{sub} – Minute ventilation; BR_{sub} – Breathing reserve [$\text{FEV}_{1\text{x}37}/\text{VE}$ (%)]]; Vt_{sub} – Tidal volume; Bf_{sub} – Breathing frequency; $\text{VE}/\text{VCO}_{2\text{sub}}$ and $\text{VE}/\text{VO}_{2\text{sub}}$ – Ventilatory equivalents for CO_2 and O_2 ; $\text{PETO}_{2\text{sub}}$ – End-tidal O_2 ; $\text{PETCO}_{2\text{sub}}$ – End-tidal CO_2 ; $\text{Vd}/\text{Vt}_{\text{sub}}$ – The ratio of Vd to Vt .

Table 3: Effects of ten (10) rebirthing sessions on selected cardiopulmonary indices measured during maximal effort.

variable	Mean ($\pm 1\text{SD}$)			
	Pre	Post	t	p
Workload, kmh/%	5.7/11.3 (0.7/1.8)	5.7/11.6 (0.7/1.9)	0.98	0.51
VO_2 , ml/kg/min	32.82 (3.91)	33.76 (4.72)	-0.34	0.37
RER , L/L	1.25 (0.04)	1.24 (0.04)	0.99	0.17
HR , b/min	185.33 (7.54)	181.75 (7.80)	2.09	0.04
O_2pulse , ml/kg/beat x100	17.8 (1.94)	18.4 (3.07)	0.98	0.35
VE , l/min	67.88 (8.43)	70.38 (10.94)	-0.85	0.21
Vt , L	1.66 (0.27)	1.60 (0.19)	0.71	0.25
Bf , b/min	41.63 (2.97)	45.25 (6.56)	-1.11	0.15
BR , %	60.5 (7.25)	62.3 (7.55)	-0.61	0.35
VE/VO_2 , L/L	40.15 (3.78)	39.93 (4.30)	0.19	0.43
VE/VCO_2 , L/L	29.98 (1.79)	31.03 (1.52)	-1.21	0.13
PETO_2 , mmHg	120.38 (2.63)	118.63 (3.47)	1.49	0.09
PETCO_2 , mmHg	36.63 (2.31)	35.00 (1.75)	1.60	0.08
Vd/Vt , %	32.63 (1.47)	33.13 (1.84)	-1.00	0.8

Workload_{sub} – Mechanical power in treadmill's speed (km/hr) and slope (%); $\text{VO}_2/\text{kg}_{\text{sub}}$ – Oxygen uptake per kg; RER_{sub} – Respiratory exchange ratio; HR_{sub} – Heart rate; $\text{O}_2\text{pulse}_{\text{sub}}$ – Oxygen pulse; VE_{sub} – Minute ventilation; BR_{sub} – Breathing reserve [$\text{FEV}_{1\text{x}37}/\text{VE}$ (%)]]; Vt_{sub} – Tidal volume; Bf_{sub} – Breathing frequency; $\text{VE}/\text{VCO}_{2\text{sub}}$ and $\text{VE}/\text{VO}_{2\text{sub}}$ – Ventilatory equivalents for CO_2 and O_2 ; $\text{PETO}_{2\text{sub}}$ – End-tidal O_2 ; $\text{PETCO}_{2\text{sub}}$ – End-tidal CO_2 ; $\text{Vd}/\text{Vt}_{\text{sub}}$ – The ratio of Vd to Vt .

DISCUSSION

This study aimed to see if there were any changes in the fitness-related physiological attributes after a series of rebirthing sessions.

There were no significant changes in either resting lung functions (PFTpost) (negating the first hypothesis) or peak values of the second maximal effort (CPETpost) after the rebirthing program (except for a decrease in peak HR) (supporting the second hypothesis). The lack of change in both the PFTpost and the maximal values of the second exercise challenge (CPETpost) suggests that rebirthing treatments do not improve either resting pulmonary functions or aerobic exercise capacity (as measured by peak VO_2) or aerobic performance (characterized by maximal workload). Nonetheless, the results show a significant reduction ($p < 0.05$) in several cardiopulmonary attributes measured during the submaximal phase of the second (post) CPET (HRsub, $\text{VO}_{2\text{sub}}$, RER_{sub} , VE_{sub} , BR_{sub} , Bf_{sub} , $\text{VE}/\text{VCO}_{2\text{sub}}$ and an increase in $\text{Vd}/\text{Vt}_{\text{sub}}$). While physiological responses at maximal effort represent the strength and power of the respective bodily systems, physiological responses during submaximal effort express the degree of efficiency and physiological stress to which they are subjected (13) when a similar mechano-metabolic load is encountered, a decrease in the above parameters indicates a more economical and less demanding physiological load. In most cases, physiological improvement in the latter (reduced submaximal responses) should result in increased maximal exercise capacity (22, 23), but this was not the case in our study. So, what could explain the above changes, which were only observed during the second exercise test's submaximal phase but not during the second resting PFT (PFTpost) or at the height of the second CPET (CPETpeak post)? First, the physiological changes observed could be attributed to a possible ventilatory "training effect" induced by the rebirthing treatments, which included ten prolonged periods of heavy breathing. But then, why were changes observed only at the submaximal effort and not at resting PFT or maximal effort? Although some authors claim that respiratory muscle training improves whole-body exercise capacity (17, 18), many researchers contend that respiratory muscle power and capacity do not limit exercise performance or affect maximal oxygen uptake ($\text{VO}_{2\text{max}}$). (19, 20, 21). Therefore, even if the rebirthing series did improve the respiratory system of the study participants, this improvement might not have led to an increase in maximum exercise capacity (VO_2 peak and/or peak workload) (17, 24), as was the case in the current study (supporting the second study hypothesis).

One obvious argument against the rebirthing regimen's functional improvement of the respiratory system is the relatively long interval between each rebirthing session (one week). Such a "break" between training sessions was most likely too long to cause an appreciable respiratory training effect of the Rebirthing treatments. It should be noted that most RMT protocols necessitate at least one training session per day, if not three or more (16, 25, 26). Furthermore, an assumed functional improvement of the respiratory system should be reflected in the second resting PFT (an increase in

the PFTpost), but this was not the case in the current study (rejecting our first hypothesis).

Therefore, it is reasonable to suspect that the changes observed during the second submaximal effort were caused by factors other than actual respiratory system strengthening. Another probable explanation for the study's findings could be the "habituation effect." "A decrease in response to repeated stimulation is called habituation." "It occurs in the nervous system and may impact the associated physiological responses to the applied stimulus." (27). Habituation is a popular explanation for a decrease in response intensity to a repeated stimulus or set of stimuli.

The term "habituation" is frequently used in the stress literature to describe a situation in which an individual has learned to perceive a repeated stressor as innocuous. (28, 29). The fact that study participants were unfamiliar with exercise testing procedures and were new to the laboratory environment at the first visit (pre) suggests that habituation played a vital role in both psychological and physiological responses at the second visit to the laboratory (post) (27, 30).

The relatively long-time interval (approximately three months) between the first (pre) and second (post) laboratory visits must be a major weakness of this argument, namely linking the improved physiological responses at a constant submaximal effort to the presumed habituation effect. A time interval of this length has the potential to "cancel out" suspected habituation.

Given that this is the first and only study to report the findings of a scientific investigation examining fitness-related physiological responses following a series of rebirthing treatments, it is not surprising that no satisfactory or conclusive explanations for the main study's findings were found. Nonetheless, it is tempting to "blame" the rebirthing sessions for the significant reduction in selected physiological responses during the second exercise challenge's submaximal phase. More research, however, is needed to provide reliable support for this claim. Therefore, we'd like to propose a few potential future lines of research to test our hypotheses further. First, a controlled study of Rebirthing with a large enough sample size representing a homogeneous healthy or clinical population is needed to determine whether rebirthing is a beneficial complementary or alternative treatment for the study population. Second, a placebo or wait-list control condition with random group assignment would significantly improve the results' interpretability. Third, more precise neuroimaging techniques, such as fMRI, should be used to pinpoint changes in brain activity during rebirthing treatment.

CONCLUSIONS

Unsurprisingly, the first study to investigate the impact of rebirthing treatments on responses of selected fitness-related physiological variables at rest and during exercise failed to provide clear answers to the research questions. More research is necessary to provide trustworthy support and explanations for the study's findings

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Author Contributions: **OI, OI, HZ, DO:** Concept, Data collection and processing, Analysis and/or interpretation, Literature review, **OI:** Writing, Revision

Ethical approval: All procedures performed in studies involving human participants were in accordance with the institutional and/or national research committee's ethical standards and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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