

IMPACT OF PHYSICAL EXERCISE ON PTSD: A REVIEW AND A SUGGESTED TRAINING PROGRAM

september 2019

ABSTRACT

The present review intends to collect and analyse previous studies on the influence of physical activity on PTSD. The number of studies currently dealing with this issue is expanding, although important lines of scientific research have not examined it thoroughly – which is bad news, especially considering the strong repercussions of PTSD on human body, which scholars have clearly illustrated. The following article will list down and group the most relevant scientific studies on the prevention role played by regular physical exercise against the chronification of a PTSD and the necessity to combine it with psychotherapy. The aims of the present work are to raise sensitivity among the scientific community on the body's pivotal role when taking charge of a PTSD and to hypothesize a combined intervention through psychotherapy and daily workout. At the end of the article, a program of suitable exercises – to be combined with the classical psychotherapeutic approach based on the so called triphasic model (recommended by current guidelines) – will be suggested.

REVIEW: THE EXISTING LITERATURE

The literature in the psycho-traumatologic field reporting strict data on the impact of physical activity on PTSD is expanding, yet still scant in terms of standard protocols and detailed guidelines on what can benefit PTSD full-blown patients. The impact of PTSD on body is known; it has been highlighted by multiple studies published on authoritative magazines and well explained by scholars who have led the way for nowadays psycho- traumatology, such as Bessel Van der Kolk with his *The body keeps the score*.

Some major magazines, such as the *American Journal of Psychiatry* or the *Journal of Clinical Psychology*, reference very recent studies involving PTSD patients to whom standardised protocols of physical exercise were applied: such studies evidence the generic importance of aerobic physical activity, aimed at developing “muscle endurance”, in order to mitigate the somatic effects of PTSD.

Here the main contributions, listed in chronological order:

- Fetzner & Asmundson (2014) investigated the benefits of regular aerobic activity (specifically, 6 sessions of 20 minutes in two weeks, i.e. 3 weekly sessions of 20 minutes) on a sample of 33 PTSD patients. The experimenters divided the group into 3 different sub-populations: the first of these was provided, during the exercises, with a “cognitive distraction” aimed at inducing the subjects to focus on other than the exercise itself or their own bodies. The second group was instead given the task of focusing on interoceptive aspects (i.e., to concentrate on the inner sensations stimulated by the exercise itself). The

third and last group was simply asked to engage in the ongoing physical activity. The aim was to understand the ways in which a standardised and regular set of exercises may impact the symptoms of an heterogeneous group of PTSD patients: in particular, the investigation on the interoceptive subgroup focused on the causes – not only the presence – of sport’s benefits on PTSD. The results, however, showed few if not no differences among the various subgroups, which may suggest a common intergroup positiveness of aerobic exercise in the treatment of PTSD. In particular, the researchers argued that exercise in general could have enabled a process of “interoceptive exposition”, i.e. have promoted an active confrontation with the body sensations stimulated by physical exercise itself. As we know, one of the key strategies – if not the main one – of PTSD management is the good handling of the somatic activation triggered by the emerging trauma. In this respect, the confrontation with the somatic sensations induced by regular aerobic exercise might prove a strong act of *exposure* to what comes from the body, regardless how much attention is paid to it.

- Rosenbaum et al. (2014) published a randomised study on *Acta Psychiatrica Scandinavica*, which investigated the difference between two types of treatment (with or without physical exercise) provided to a group of 81 patients with primary PTSD (diagnosed according to the criteria of the DSM IV, excluding those cases better defined by complex trauma and those suffering from chronicle physical pathologies, both likely to spread confusion in the process of analysis). The conclusions showed a higher improvement in the conditions of those who had been treated also with physical exercise (specifically, 30 weekly minutes of cardiofitness in hospital, two sessions at home and a controlled program of minimum walk – up to 10,000 steps per day – for each subject).
- Vancampfort et al. (2016) carried out a review on a sample of about 1,400 people with PTSD, highlighting a correlation between hyper-arousal and physical activity. They argued that one of the benefits of physical activities for PTSD patients might lie in their very process of habituation to the states of hyper-arousal, which are in fact better tolerated and managed through regular exercise.
- Wolf Mehling et al. (2017) observed, on the *Journal of Clinical Psychology*, how a sample of 47 veterans subjected to physical training and mindfulness-based techniques for 12 weeks had experienced a general reduction of the dysregulative effects of the PTSD-typical hyper- arousal states, thus experiencing a general improvement of their life quality.
- Vancampfort et al. (2017) published a meta-analysis carried out on 5 studies for a total of 192 PTSD patients, who had been treated with psychotherapeutic rehabilitation in combination with physical training; the authors evidenced the presence of certain psycho-physical benefits and reduced symptoms of hyper-arousal and avoidance, which led them to generically encourage the adoption of “2 weekly resistance-training sessions together with 150’ of moderate exercise (or two 75’ sessions of vigorous exercise) per week”.
- Oppizzi and Umberger (2018) carried out a deep meta-analysis of the pre-existing literature, hence publishing one of the most exhaustive contributions to the research on the topic. The key points of this meta-analysis may be synthesized as follows: a) higher impact of aerobic activity – such as brisk walking, rope skipping, jogging, cycling – on PTSD;

b) increasing evidence of the significant benefits of Yoga practice on PTSD symptoms; c) importance of constant physical training and d) centrality of sleep quality, which is improved by physical activity, as a therapeutic element in relation to PTSD. Furthermore, some hypotheses were made about the mechanisms underlying the benefits of physical exercise on PTSD: a) *expositive* hypothesis (some reasoned exercise would allow PTSD patients to slowly familiarize with the somatic sensations triggered by traumatic experiences); b) *regulative* hypothesis (exercise would help to decrease the hyper-arousal states and escape the hypo- arousal ones) and c) *physiological* hypothesis (regulation of the hormones released by post- traumatic stress, liberation of endorphins, increased brain neurotrophic factor).

- Hegberg et al. (2019) exhaustively examined 19 studies carried out on PTSD-diagnosed subjects, which dealt with the correlation between the use of aerobic exercise only (thus excluding Yoga and other practices) and PTSD levels. The results showed evident links between aerobic activity and decreased PTSD symptoms; nonetheless, the authors called for further research (namely RCT studies) in order to evaluate a possible causality between the two events. This article helpfully and punctually sets a series of hypotheses about the mechanisms of action of physical exercise in terms of benefits on PTSD.

Specifically, the authors mention:

- *desensitization and exposure*: A subject exposed to aerobic (including vigorous) exercise stimulating an hyper-arousal condition is likely to interpret that very physiological alteration as non-pathological in contexts of non-exercise (for instance, in case of an intense tachycardia due to vigorous exercise, that very tachycardia will be ideally interpreted as less “dangerous” also in daily life);
- *cognitive impairment*: the authors noted the absence of studies relating physical exercise and better cognitive performances in subjects suffering from PTSD. However, a vast quantity of studies about the improvement of some cognitive functions in the elderly (in particular executive functions and episodic memory) suggested that the same improvements would be detected in PTSD patients, also younger ones (those very cognitive functions – episodic memory and executive functions – being the most compromised in the PTSD);
- *anatomic functions and altered brain structures*: here also the authors evidenced the absence, upon publication, of studies examining the morphology (altered or not) of specific brain areas following a period of specific training; however, they noted that various studies showed a positive impact of aerobic exercise and “cardio-respiratory fitness” on the morphology of many brain areas in elderly patients – the same areas which proved altered following the development of PTSD;
- the studies regarding the *hypothalamus-pituitary-adrenal axis* (HPA) in healthy subjects show how physical activity helps keep its functioning regular: the authors of the article suggested that such a positive effect could benefit the functioning of this axis also in PTSD patients. In this population, in fact, the impact of post-traumatic stress on the HPA circuit, due to an alteration of its feedback mechanism, had been observed; however, the authors pointed out that the studies on the HPA axis in correlation with PTSD seemed too scarce to provide reliable data.
- Finally, the authors observed how multiple evidences in literature referred to the correlation existing between alterations of the immune system and the presence of

prolonged stress, in particular in relation to the concept of *inflammation*; the de-inflammatory effects of physical activity and its beneficial effects on various aspects of life, among which sleep quality, are well documented in literature. The authors noted the core importance of sleep in the resolution of a PTSD, since a significant processing of the mnemonic data (cognitization) takes place during sleep. (Pagani et al., 2017)

NEUROCOGNITIVE AND NEUROPHYSIOLOGICAL ASPECTS: SOME SPECULATIVE ASSUMPTIONS

The work of Hegberg et al. represents the most exhaustive contribution in literature so far; in general terms, as it explains, there are different theories regarding the mechanisms which make aerobic physical activity a potential integration to the standard treatment of PTSD, theories attributable to 4 hypotheses:

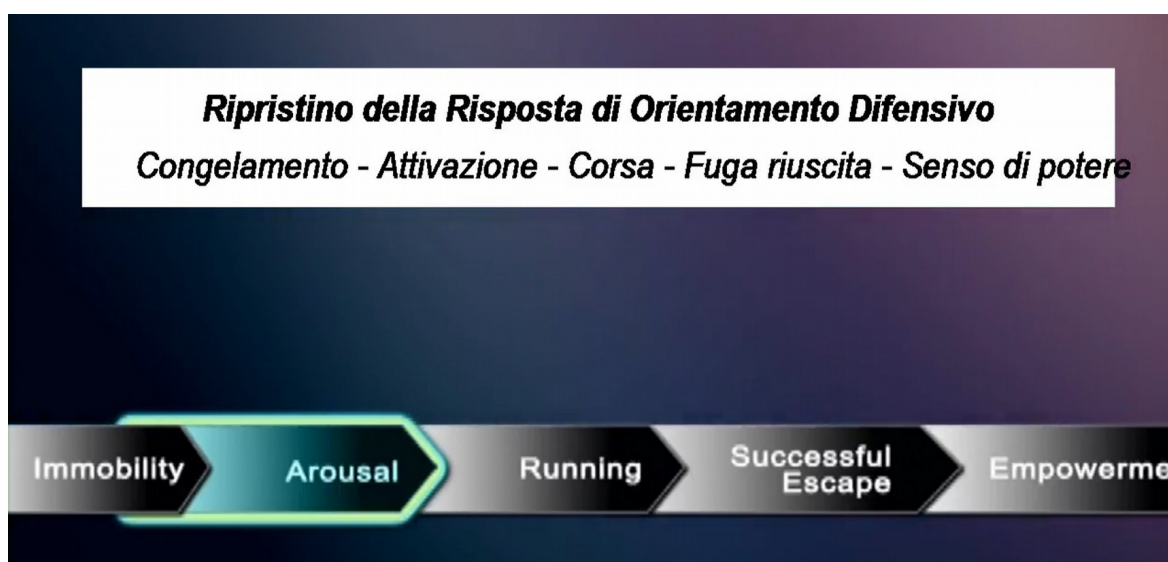
1. Hypothesis of auto-regulation

Using the body for *regulatory purposes* can be considered a mastery strategy, meaning an *active behaviour promoting the recovery of mastery status in terms of emotional regulation*, in case this last ability has been lost. There are different ways to recover the mastery: the body represents an often effective, although primal, way to fall into line with what Daniel Siegel calls “window of tolerance”. Physical activity allows to soothe states of neurophysiological dysregulation when these are excessively upward in tendency (hyper- arousal) or to promote a “return to life” against states of seemingly invincible de-activation (hypo-arousal). We know in fact that PTSD determines dysregulations towards both hyper-arousal and hypo-arousal.

2. The body dissipates the trauma

This expression, borrowed from one of the world leaders in the somatic approach to trauma, Peter Levine, expresses the sense of letting the traumatic experience out through the body. The studies of Pat Ogden (Levine’s student) focus on the development and the put in practice of the “action tendencies” blocked during and after the trauma. Levine carried out long studies on animal behaviour about trauma in neural-biological and ethological sense. Animals, when not marked by past traumatic experiences, respond effectively to single traumas “shaking” them off their bodies, thus restoring the pre-trauma neuro-physiological state through the body. Humans are not always able to do so: despite the substantial inter-specific overlapping of the oldest brain parts observable in vertebrate animals, human brain system is equipped with some powerful tools of storage and problematization of experienced reality, which paradoxically lead to an excessive and distorted storage of the trauma itself. Levine speaks about as an excess of physical “energy” which, unable to develop in a biological sense because of the state of deep impotence experienced during the trauma, remains in the body perturbing it (post-traumatic stress): this aspect of Levine’s theory precedes and is comparable to the already mentioned “action tendencies” theorized by Pat Ogden, which should ideally be “taken out” through sensorymotor channels, i.e. through the body (first vehicle and natural site of the escape/attack reactions triggered by threats), with some semantic nuances (Pat Ogden defines the action tendencies as a highly finalized movement, Levine as a “too full” that must be let out. Sport, in this respect, might be conceived as a vehicle for letting out the action tendencies matured during the trauma. Levine describes as somatic effects of PTSD

reactions such as tremors, excessive sweating, cold hands: according to him, such medical signs might tell us about an autonomous response of the central nervous system, blocked in an abnormal, prolonged “defence mode” as if expecting a new hypothetically forthcoming traumatic event. Levine, together with other scholars, interprets these signs and symptoms as bodily “spies” of something that needs to be evacuated or dissipated (e.g. an intense anger left unexpressed, an impossible escape from the body). For example, when observing an animal emerging from a state of apparent death, we can see that the animal evacuates the state itself by means of trembling: some animals – such as bears – tend to tremble more (they are shaken by intense tremors which then quiet down), others less. Tremor represents a natural response aimed at dissipating terror and anxiety: some psychotherapeutic schools (pertaining, although indirectly, to the school of thought of sensorymotor psychotherapy) prescribe its voluntary self-induction as an instrument to discharge the energies. The “discharge of fear” process following a strong shock or trauma seems in fact to necessarily happen, in nature, through the end. We know that animal behaviour recapitulates, in a certain simplified sense, our own behaviour, and that sometimes we can learn, from the observation of animals, that which we hardly manage to observe in ourselves. The work done by Peter Levine teaches us that the body must be “discharged” following a strong activation: sport, in this respect, provides an ideal and modular container to successfully express such blocked tendencies.



The image above describes an ideal sequence which brings from immobility to the recovery of an empowerment condition through running. The “running” tool is in this case used as a means for the development and achievement of the fight-or-flight response which was kept frozen by the trauma (Levine effectively explains how, in order for a trauma to settle, there must be an association of immobility and fear: it takes to dissociate and solve in a clinical sense these two aspects of the patient’s life experience to free him from the trap of the post-trauma).

3. Interoceptive exposure therapy

Exposure therapy finds itself on the concept of rehearsal, i.e. repetition and habituation, which makes it an effective coping tool in those cases where the tendency would instead be that of “avoiding”. Rehearsing a public speech, attending places perceived as dangerous to get

then used to them, indulging in the reading of inner states of fear and terror, are all examples of exposure strategies used to make those very stimuli (both inner and outer) less “activating”. One of the consequences of PTSD is the continued inner and outer avoidance of all that concerns the trauma and the context in which it took place: the expression “phobia of interior states” is used to indicate the result of an individual’s total avoidance of that which might elicit a dysregulated body reactivation (inner triggers such as thoughts and images able to provoke a traumatic break-in are avoided). According to this hypothesis, physical activity would allow the re-appropriation of a higher sense of control, through exposure and habituation, on the body sensations induced by regular exercise.

4. Antidepressant and anxiolytic effect of physical exercise

Multiple studies have valued and shown the positive impact of physical exercise on symptoms of depression and anxiety stemming from various life experiences. If we consider the “network” theory of mental disturbs promoted by Denny Borsboom, according to which psycho-pathological symptoms are to be considered as horizontally located on the individual’s psychological scene, connected and interdependent, we can see also an indirect impact of physical activity on PTSD, i.e. its impact on some of the side symptoms of post-traumatic stress itself, such as severe insomnia or general anxiety. In fact the cognitive performances of a PTSD patient daily coping with the management of the disturb generally improve with the improvement of sleep quality. It must be remembered that post-traumatic stress finds itself on the constant adaptation to a reality which is perceived as threatening: to face it in a state of prostration from lack of sleep makes it even more threatening (Pierre Janet already described as easier for a potentially traumatic event to take roots in the mind of its victim in conditions of “psychic tiredness”). The same could be said about depressive experiences from “exhaustion”: to provide imbalances or increases of mood through the body (e.g. stimulating the production of endorphins through a prolonged session of aerobic exercise) should be considered an attempt to generally improve life quality in the perspective of a subsequent liberation from primary PTSD.

A SUGGESTED TRAINING PROGRAM

In the light of the above-mentioned research studies, which lead to generally encourage the integration of regular aerobic physical exercise in conventional PTSD therapy, it is useful to hypothesise a suitable weekly training program, besides clarifying the reasons behind its formulation. This standard program might be used to produce future research studies on samples of people suffering from PTSD, to whom it might be prescribed.

The weekly program envisages 3 sessions of up to an hour; it is suitable for any man or woman aged 18 to 60 (which is actually a precautionary range, since it can be extended to different ages following medical evaluation) not showing any current or prior medical conditions. The program has been formulated with the advice of Michele Avico (graduated in Sports Sciences at Università di Torino), fitness and postural gymnastics trainer certified by AICS (Italian Association for Culture and Sport).

The program is structured in the following way (the chart clarifies the objective underlying each suggested exercise, with a focus – last column on the right – on the background psychotherapeutic principle):

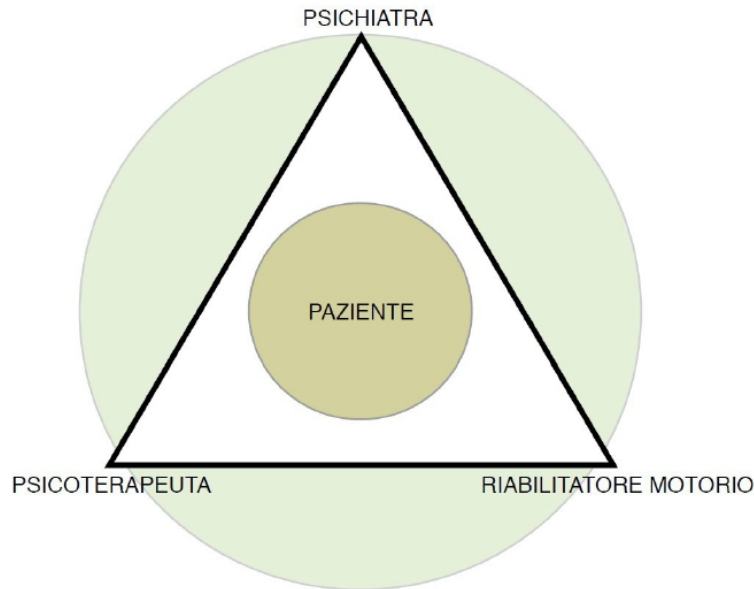
<u>DAY</u>	<u>WHAT</u>	<u>WHY</u>	<u>SENSORYMOTOR ASPECTS</u>
MONDAY	Dynamic stretching – 10'	Transmission of synovial fluid to joints/ raise of body temperature/ postural improvement	
	Pliometric squats – 3 sets of 15 (simplified version: bodyweight squats)	Improvement of strength, energy and lower limb coordination	Release of action tendencies
	Push ups – 3 sets of 15 (simplified version: push up to suspension trainer or chest press)	Strengthening of heart, pectorals and arms	Release of action tendencies
	Pulldown exercise – 3 sets of 15	Strengthening of back muscles	Grounding
	Aerobic activity – 20' (preferably cross-trainer, otherwise treadmill or bike)	Improvement of aerobic capacity	Grounding
	Proprioception of ankle with float board – 3 x 45" per leg	Improvement of ankle proprioception/ balance improvement	Grounding
	Global static stretching with focus on posture and breathing improvement (applying the principle of "diaphragm breathing" common in yoga) – 10'	Muscle stretching/ postural improvement/ increased elasticity of lung tissues	Grounding
WEDNESDAY	Dynamic stretching – 10'	Transmission of synovial fluid to joints/ raise of body temperature/ improvement of proprioception/	

		postural improvement	
	<p>CIRCUIT 1 to be repeated three times (with a 1' - passive recovery after each set)</p> <ul style="list-style-type: none"> • planks in isometric contraction – 40'' • 15 lumbar contractions in prone position • punch out drill - 1' 	Strengthening of heart and lumbar area/ postural improvement/ improvement of aerobic and anaerobic capacity	Grounding, release of action tendencies
	<p>CIRCUIT 2 to be repeated twice (with a 1' - passive recovery after each set)</p> <ul style="list-style-type: none"> • isometric squats with proprioceptive float board – 30'' • 15 bench presses • rowing machine – 3' 	Improvement of ankle proprioception/ increased strength and coordination of upper body/ improvement of aerobic capacity	Grounding, release of action tendencies
	Global static stretching with focus on posture and breathing improvement (applying the principle of “diaphragm breathing” common in yoga) – 10'	Muscle stretching/ postural improvement/ stress reduction/ increased elasticity of lung tissues	
FRIDAY	Dynamic stretching – 10'	Transmission of synovial fluid to joints/ raise of body temperature/ improvement of proprioception/ postural improvement	
	<p>CIRCUIT 1 to be repeated three times (with a 1' - passive recovery after each set)</p> <ul style="list-style-type: none"> • 10 pilates crunches with spine articulation 	Strengthening of the heart/ postural improvement	Grounding

	<ul style="list-style-type: none"> • 10 cat-cow stretches 		
	<p>CIRCUIT 2 of muscle endurance to be repeated twice with no pause</p> <ul style="list-style-type: none"> • Standing elastic band rowing • Isometric push-up position – 45’’ • 15 barbell deadlifts • aerobic activity – 3’ 	<p>Improvement of aerobic capacity/ Improvement of muscle resistance/ strengthening of posterior chain</p>	<p>Grounding, release of action tendencies</p>
	<p>Punch out drill – 10’</p>	<p>Improvement of aerobic capacity, improvement of foot-eye coordination</p>	<p>Grounding, release of action tendencies</p>
	<p>Dynamic stretching – 10’</p>	<p>Transmission of synovial fluid to joints/ raise of body temperature/ improvement of proprioception/ postural improvement</p>	<p>Grounding</p>

CONCLUSIONS

The present review follows on from previous articles aimed at evidencing how the bodily channel can affect some core neuro-physiologic and somatic symptoms of PTSD. A reasoned use of a specific workout program, combined with triphasic psychotherapy, could accelerate the recovery time and induce a higher sense of grounding, stability and mastery. It has not been possible here, due to lack of resources, to undertake an in vivo trial path of the suggested training program on a suitable sample of subjects. I wish it will be undertaken in the future by experts interested in the topic. Ideally, the taking charge of a PTSD could, in the future, benefit also from experts in athletic training specialized in the treatment of PTSD, who would merge with a specialist team – together with psychotherapist and possible psychiatrist – able to act in parallel on PTSD.



BIBLIOGRAPHY

Borsboom D. & Cramer A. O.J. (2013). Network Analysis: An Integrative Approach to the Structure of Psychopathology, Annual Review of Clinical Psychology, 9:1, 91-121

Hegberg, N. J., Hayes, J. P., & Hayes, S. M. (2019). Exercise Intervention in PTSD: A Narrative Review and Rationale for Implementation. Frontiers in psychiatry, 10, 133. doi:10.3389/fpsy.2019.00133

Levine, P.A. (2014) Somatic Experiencing, casa Editrice Astrolabio, Roma

Mathew G. Fetzner & Gordon J.G. Asmundson (2015) Aerobic Exercise Reduces Symptoms of Posttraumatic Stress Disorder: A Randomized Controlled Trial, Cognitive Behaviour Therapy, 44:4, 301-313, DOI: [10.1080/16506073.2014.916745](https://doi.org/10.1080/16506073.2014.916745)

Mehling, Wolf & Chesney, Margaret & Metzler, Thomas & Goldstein, Lizabeth & Maguen, Shira & Geronimo, Chris & Agcaoili, Gary & Barnes, Deborah & Hlavin, Jennifer & Neylan, Thomas. (2017). A 12-week integrative exercise program improves self-reported mindfulness and interoceptive awareness in war veterans with posttraumatic stress symptoms. Journal of Clinical Psychology. 74. 10.1002/jclp.22549.

Ogden, P., Minton, K., Pain, C. (2006). Il trauma e il corpo. Manuale di psicoterapia sensomotoria. Tr.it. Istituto di Scienze Cognitive Editore, Sassari 2012

Pagani M, Amann BL, Landin-Romero R and Carletto S (2017) Eye Movement Desensitization and Reprocessing and Slow Wave Sleep: A Putative Mechanism of Action. Front. Psychol. 8:1935. doi: 10.3389/fpsyg.2017.01935

Philip & Rosenbaum, Simon. (2016). *Physical Activity in People With PTSD: A Systematic Review of Correlates*. *Journal of Physical Activity and Health*. 13. 910-918. 10.1123/jpah.2015-0436.

Rosenbaum, S, Sherrington, C, Tiedemann, A. (2014) *Exercise augmentation compared to usual care for post-traumatic stress disorder: a randomized controlled trial*, *Acta Psychiatrica Scandinavica*, Vol. 131, Issue 5, Pag. 350-359

Siegel, D. (2013). *Il Terapeuta consapevole. Guida per il terapeuta al Mindsight e all'Integrazione neurale*. Sassari: Istituto di Scienze Cognitive Editore

Vancampfort, Davy & Stubbs, Brendon & Richards, Justin & Ward, Philip & Firth, Joseph & Schuch, Felipe & Rosenbaum, Simon. (2016). *Physical fitness in people with posttraumatic stress disorder: a systematic review*. *Disability and Rehabilitation*. 39. 10.1080/09638288.2016.1226412.