

## ORIGINAL STUDIES

# The impact of Health & Wellness Coaching intervention on the level of stress perceived physically/mentally/psychologically

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## Abstract

**Background.** Stress, a phenomenon which has turned into an epidemic, is a major health concern because it affects the general population, having a strong negative impact on the psychoemotional, physical and social health.

**Aims.** The aim of this research was to investigate the impact of Health&Wellness Coaching (HWC) intervention on stress levels, as evidenced by physical/mental/psychological changes, and to identify non-invasive ways of early detection of high stress levels, which may play an essential role in the prophylaxis of chronic diseases often associated with stress.

**Methods.** The HWC intervention was carried out on 24 subjects, and consisted in 8 online sessions for each of them. The sessions were mixed training and coaching sessions, held once every two weeks, and lasted for approximately 60 min/session. In the training sessions, useful medical information related to stress was provided (info training), while in the coaching sessions subjects were guided and empowered to reduce their stress levels.

**Results.** The results showed an optimization of physical/mental/psychological parameters, with a simultaneous decrease in perceived stress levels, and a favorable impact on the subjects' quality of life, as evidenced by psychometric measurements (DASS\_21R, Decisional Capacity and QOLI) and mental/brain measurements using fNIRS technology (Functional Near-Infrared Spectroscopy, with the Mendi device).

**Conclusion.** The present research confirms that HWC is an effective intervention in reducing the level of perceived stress and we believe that it can be a promising alternative for the prophylaxis of chronic diseases, and that DASS-21R could be a useful tool for the detection of a high degree of psycho/emotional/mental impairment, which can negatively influence the level of stress in the body, i.e. QOLI can detect the most affected areas of satisfaction with life.

**Keywords:** stress, depression, anxiety, decisional rationality, quality of life, health & wellness coaching, training, neural activity, resilience.

## Introduction

*Stress*, a vague concept, too little understood and too often used, generally in a negative context, increasingly affects many areas of life, from medical, psychological, social, etc., but each area has a different understanding and interpretation of it. It is important that, at least from a psychomedical point of view, there should be a single understanding, so that it can be readily understood, in order to adopt the correct approach, essential for achieving and maintaining optimum health. We appreciate that this vague

concept, has bizarrely become a major health problem, being classified by WHO as „the health epidemic of the 21st century” (Singh et al., 2019), because stress is actually a physiological mechanism of adaptation of the body to the environment, necessary for survival. In fact, the issue at stake is the level of stress, which is also the topic of this research and which can turn stress into distress, with the potential to manifest as disease, when the body's energy resources are overstressed or exceeded.

It is known that there is a strong relationship between stress and chronic diseases (Hwang & Oh J, 2024), in most

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cases with a negative impact on the personal quality of life. Consequently, it is vital to understand this relationship in order to intervene prophylactically, not curatively, so that the chances of success will be higher and the health costs lower.

Given the 2008 WHO statistics, which show that 63% of deaths worldwide were caused by preventable diseases, and the estimated costs of around \$47 trillion by 2030 (Hacker, 2024), we chose this research topic.

From a general perspective, stress has both an objective and a subjective component (Mariotti, 2015), but it is not identical with emotional arousal or nervous tension, these states are only specific effects, usually affecting only one system of an organism (Selye, 1976), not the organism as a whole. However, from a biological and medical point of view, stress is the body's non-specific response to any demand and is closely related to energy use (Selye, 1976).

We believe it is necessary to make a clear distinction between this non-specific response, present in both plants and primitive animals that do not have a nervous system, and in humans during deep anaesthesia, and specific responses. Thus, the stress reaction, or *the nonspecific response*, is a response common to all demands acting on living organisms (Selye, 1976), conscious or unconscious. In contrast, *specific responses* such as emotional arousal, occurring in the case of demands made on the nervous system, occur at the mental/psychic/emotional level and only in the waking state. Regardless of the type of stressors that threaten the psychobiological integrity of the body, they have both non-specific effects and specific effects, inseparably linked to the former, which they constantly modify. Another category of variables influencing the stress effect are exogenous and endogenous conditioning factors, specific to each individual and determining the reactivity of the organism (Selye, 1976). In recent years, numerous studies have shown that interventions for the prevention and management of stress could produce changes, including at the molecular level, with profound functional consequences, such as altering the expression of genes linked to the modulation of the response to psychobiological stress (Stoffel et al., 2022). It is quite promising that the type of intervention such as HWC, which targets components of health, including stress management, already has beneficial effects confirmed at the physical and psychosocial level, with a possible positive impact on chronic disease prevention (Smith et al., 2022).

In addition to the need for a clear definition of the concept of stress which everyone can understand, there is also a need to recognise the early warning signs so that a timely intervention can be taken before various symptoms appear. Therefore, the aim of this research was to find easy and minimally invasive ways of early detection of high levels of stress, inappropriate for health, and effective ways of intervention to adjust it prophylactically, with the aim of reducing health costs.

Given that there are currently no clear points of intersection between the physical and psychoemotional components attached, even if they collaborate in generating a certain level of stress, we hope that through this paper we make a contribution to connecting and highlighting them. Basically, by intervening at the psychological/mental/

emotional level with the help of HWC, we were able to capture changes at the physical level as well, evidenced by mixed ratings of stress levels in the body.

## Hypothesis

This research aimed to discover new non-invasive methods for the early detection of high stress level and to investigate the effectiveness of HWC intervention in reducing stress level for chronic disease prophylaxis.

## Objectives

Thus, we used psychometric tools (DASS\_21R, Decisional Capacity and QOLI) and mental/brain level measurements using fNIRS (Functional Near-Infrared Spectroscopy, using the Mendi device) technology. Psychometric and Functional Near-Infrared Spectroscopy (fNIRS) measurements were assessed at both T1 and T2 (before and after the HWC intervention): 1. The level of perceived stress, anxiety and depression; 2. Decisional capacity; 3. Quality of life; 4. Neural activity; 5. Resilience; and 6. Ability to control brain activation.

## Material and methods

This research was focused more on the area of prevention, the HWC intervention took place online, did not require the use of drugs and/or invasive medical procedures, being a type of research at the border between medicine and wellness, and was conducted according to the ethical standards recommended by the World Medical Association (Helsinki) (1).

### Research protocol

#### a) Period and place of the research

The research was conducted over a period of approximately 3-4 months (June 2023 - September 2023).

#### b) Subjects and groups - Study setting

At the end of May 2023 we held an online webinar – *Is stress good or bad?* - which was attended by a few dozen people, following which 24 subjects were enrolled in this research. All of them reported high levels of stress. They were informed about the topic of the research, about the way in which the HWC intervention would proceed and the assessment modalities, and then gave their written informed consent. In this research, we included only adult subjects, aged between twenty and seventy-two years, female (13) and male (11), with education levels ranging from high school, undergraduate, graduate and postgraduate, who did not report any chronic diseases. Subsequently, each subject received an envelope at home with details of participation including informed consent to be signed, a personal code used throughout the research, and questionnaires to be completed at time T1 before the start of the first session. Two successive days were also established for the brain measurements. The same procedure was used at time T2, the end of the intervention, after the last session.

#### c) Used instruments - Applied tests

Data collection was carried out using the following tests, measurements and methods:

- *Psychometric tests*: DASS-21R - Depression, Anxiety and Stress Scales (Lovibond et al., 2011); Decisional capacity (2); QOLI- Quality of Life Inventory (Frisch & Livinți, 2014).

- *Measurements at brain level: fNIRS technology - Mendi device (3)*

- *Methods: HWC method*

The personalized HWC intervention was carried out online, according to the time availability and mental disposition of the subjects, with the first author acting as a guide (doctor & coach & trainer). The aim was to convey information and empower subjects to reduce their stress levels in order to improve their personal quality of life in a prophylactic sense. The intervention took place over 8 sessions on 8 different days, one session every 2 weeks or so. The first two individual sessions were a combination of training with minimal coaching interventions, followed by 5 individual coaching sessions combined with random training interventions, and the 8th session was group coaching to support and maintain the subjects' results.

*The first online one-to-one training session with small coaching interventions (80 min)* - took place after T1 data collection, with the last data extracted by completing psychometric tests in the first 15-20 minutes of the session. This was followed by establishing a connection (raport) with each individual subject, in order for them to develop the openness needed to receive, process the medical information and understand the topics delivered (info training). We offered them a novel perspective on how the brain works, how thoughts arise and how they influence our behaviours and life. We also covered topics such as neuroplasticity, stress from a biological/medical point of view, and which are the stress triggers that activate certain pleasant or unpleasant reactions and states. Then we analysed stress, anxiety and depression from a psychological point of view and explained their relationship with biological/medical stress. At the end of the first session, the subjects were given the responsibility to monitor and record their pleasant/unpleasant states and reactions and their relationship to the factors/stresses that generated them for two weeks until the next session.

*Session 2 online individual training with small coaching interventions (60 min)* - After a first assessment with the help of psychometric tests, we continued the relay of general medical information related to: epigenetics, healthy lifestyle, neuroscience, coaching and what is the connection between them, what are emotional disorders and where they come from, conscious and unconscious breathing, etc., as well as specific information for each subject in relation to the result of the personal assessment. Therefore we dealt with topics such as: self-esteem, stressors and personalised somatic or psychological reactions, perceived physical or psychological/emotional tension, certain medical conditions of personal interest, personal values and goals, job and relationship with money, interpersonal relationships, etc. All subjects expressed a desire to reduce their perceived stress level and improve their energy level and quality of life.

It should be noted that when we referred to stress during the working sessions, the subjects had the same understanding almost unanimously, namely that stress is a state of nervous tension and/or emotional excitement, which affects their well-being and gives them a feeling of insecurity and/or anxiety, fear, agitation, frustration, all of which influence their behaviour and personal and/

or professional life. Also, none of the subjects had a clear differentiated perception of the three negative affective states: *depression, anxiety and stress*. Therefore we felt it was important to receive this information in order to first clarify the difference between „biological/medical stress” and the psycho/emotional state called „stress”, as well as the relationship between the three negative affective states. Psychologists, for example, believe that there are correlations between the three negative states, which could reflect a common etiology and discuss two possible causes. The first would be *vulnerability* as a personal trait and the second a *common environmental activation*, basically an overlapping of the conditions that activate the aforementioned negative states (Lovibond et al., 2011). In other words, these concepts are similar to those developed by Selye H, namely „endogenous and exogenous conditioning factors”. They can influence both the state of the person concerned, manifested as specific psycho-emotional or physical effects, and the level of stress in the body, manifested as non-specific effects. It is also vital to understand stress by taking into account the human brain - the central component of our identity (Pittella, 2024), as we humans have the most sophisticated central nervous system and this is probably one more reason why psycho/emotional arousal is one of the most frequent initiators of physical stress. However, if stress can be caused by both pleasant and unpleasant situations, it is the intensity of the coping demand that the situation generates which determines the level of stress in the body and can generate distress. At the end of the session we analysed together the states and reactions of each subject related to the specific triggers, as monitored by them. As an exercise for the next two weeks they received the task to become aware of the link between triggers and the generated automatic reactions which gave them an unpleasant state, as well as to block those reactions and implicitly the unpleasant state, using the method of conscious breathing combined with cognitive shifting in an area of the past chosen by each subject individually.

*Session 3 online individual coaching with targeted training interventions (60 min)* - Most subjects were able to become aware of their triggers and automatic reactions, but were not able to block them 100%. Those who scored lower on dysfunctional mental states and unsatisfactory quality of life did not succeed at all in blocking their automatic reactions at this stage. However, a first objective was achieved almost unanimously, namely raising awareness of reactions, and we agreed to work on the second goal, blocking them in order to gain conscious control over these dysfunctional mental states. *The info training* in this session focused on deep abdominal breathing and acquired automatic reactions, which helped all subjects to understand more deeply how those reactions, followed by the unpleasant states, came about. This understanding gave them additional motivation to adopt new behaviours in the future. At the end of the session, conscious abdominal breathing exercises were carried out and we worked with each of them individually on specific triggers through role sharing. Basically each subject was stimulated on the sensitive area(s), and then we practiced the conscious breathing procedure combined

with cognitive shifting in that unique area from the past, easily accessible to all, which produced for each subject the most intense discharge of hormones/neurotransmitters with a role in regulating mood and perception of happiness. For the next two weeks, they went with the same theme, but more focused on the cognitive shifting in that unique area where they remained for a few minutes, as much as possible. The role of this exercise was to release/destroy the subconscious thoughts, the existing brain circuits that led them into the reactive area.

*Session 4 online individual coaching with targeted training interventions (60 min)* - After the first stage when subjects blocked the specific triggers/stressors, we encouraged them to go further and define and interpret their current situation. Then followed an attempt at consciously and correctly offering a personal reinterpretation of the respective situations. We worked with them individually on areas identified as deficient, e.g. health, self-esteem, goals, love, personal, professional relationships, etc., in order for them to gain a deeper understanding of meaning and where appropriate, a healthier personal reinterpretation, so that they would find viable alternative solutions which otherwise would not have been taken into consideration. This was possible with most of the subjects, as previously existing subconscious unconstructive thoughts/neural circuits were no longer reinforced by the automatic reaction mode, which helped them to save energy. That energy could then be used to find new options/solutions to existing problems. *Info training* in this session focused on the formation and destructuring of neural circuits/connections at the brain level. At the end of the session, as a theme for the next two weeks, each subject was asked to continue the previous trainings, and in addition they were given the task to define in writing a new perspective on the ideal personal and professional life. Up to this stage there were no apparent barriers, each subject being eager to continue their development, motivated by the change in their personal psycho-emotional/physical state and affirmatively by a better quality of life.

*Session 5 online individual coaching with targeted training interventions (60 min)* - Subconscious/unconstructive thoughts started to disappear, most of the subjects reached a neutral state, automatic reactions significantly decreased, they were more satisfied, at peace with certain situations, ideas, while feelings of anger, nervousness, agitation, anxiety, panic, etc. almost unanimously disappeared. They all became aware of the inheritance acquired from the family micro-environment, which manifested itself in the form of automatic reactions/behaviours, and those who were parents realised that they in turn passed on the same inheritance to their children, namely the same defence mechanisms necessary for survival but not for evolution. *Info training* in this session focused on ways to communicate. Only few subjects remained in the emotional and financial survival zone, where they still felt disregarded and wanted to be recognised and appreciated by others. Until this session we worked mostly on the past and present with the help of conscious breathing, and at this stage we started to focus on the present and future. Almost unanimously they outlined their new perspective on their ideal life, following an awareness training on the

mental/emotional states connected to this new perspective. At the end of the session, as a theme for the next two weeks, they had to continue the previous trainings, and in addition they had to write and carry out actions in the direction of the new perspective of life, chosen by each one. They also had to write down the thoughts and states that arose as they moved in that direction, and if more unconstructive thoughts arose, they followed the conscious breathing procedure plus the cognitive shifting in that single area. Affirmatively, there were no major blockages, and subjects were more open, expressing their feelings much more easily, without fear of being hurt, rejected or perceived differently by others.

*Session 6 online individual coaching with targeted training interventions (60 min)* - Most of them started a new path in life, some personally, others professionally, being more aware of their physical, psycho/emotional state and the actions they undertake. They react less and less, some have stopped reacting altogether, but instead they act consciously according to their new life plans. They are more confident in their own strengths, assertive with increased energy levels in the body, more open to communication, no longer waiting for advice/guidance/appreciation from outside and they started to engage more in actions and relationships that bring them joy and give them a sense of well-being. Basically they became more independent, more mentally flexible and more open to knowledge. *Info training* in this session focused on soft skills. At the end of the session, as a theme for the next two weeks, they had to continue the previous trainings, to which new actions directed towards their chosen area are constantly added. In addition, those who still had reactive states were given the task to write down in simple phrases taken from memory, those words, situations, attributes, etc., that still negatively influence their lives and to realize that these are only legacies, with a role in survival, they are not necessarily real and no longer represent them now. Then they had to choose those thoughts/phrases that represent them now, following the process of appropriating them. At this stage the barriers were insignificant, almost all of them had a real perception of the surrounding reality.

*Session 7 online individual coaching with small training interventions (60 min)* - Those who started on a new path, began to develop new skills and abilities in that direction, personal and/or professional, almost entirely dissociated themselves from „inherited thoughts” and were moving forward with their chosen conscious thoughts influencing their new feelings and actions in a positive and constructive way. They began to choose only those actions that they do joyfully every day and that are 100% dependent on them. *Info training* in this session focused on the difference between the role of the brain in humans and other species. Thus we are endowed with the ability to exercise creative conscious actions, which can change the environment over large distances in a positive, constructive way, unlike other species, which can only adapt to the environment. At the end of the session, as homework for the next two weeks, those who did not reach the state they had envisaged, had to continue their training. Most of them, however, managed to choose those thoughts/phrases that represented them at present and replace the old unconstructive ones.

For the last session, they all had as a task to prepare a short presentation of themselves and their personal evolution during the 7 sessions.

*Session 8 online group coaching* (120 min) - in which all the subjects present described their progress during the 7 sessions in positive and constructive terms, even though not all of them reached the desired goal. All subjects considered that their perceived stress level was much lower than it was initially, they also felt their energy level had increased and their well-being and quality of life improved considerably. The process of evolution is just in its incipient stage, and each individual subject, now endowed with new knowledge and understanding, is going to self-regulate his or her state and actions in order to maintain the optimal level of stress in the body necessary for optimal health. The aim of this session was for everybody to share one another's personal achievements, thus strengthening everyone's motivation to continue on their chosen path, and to offer psychological/emotional support to those who have not yet reached their desired goal. At the end of the group session, we used the same working method as at T1, with regard to data collection.

d) *Statistical processing*

Statistical analysis was performed using GraphPad Prism 9.3.0 software (GraphPad Software Inc., San Diego, USA). The results are presented as median and range (minimum-maximum). In order to compare the differences between various time points (T1 and T2) within the same subjects group, paired t-test and Chi-squared test were used. P-values < 0.05 were considered statistically significant.

**Results**

The DASS questionnaire is a scale developed to assess and measure the constructs of depression, anxiety and stress, and the DASS-21R, which contains 21 questions, has been adapted and standardized for the Romanian population. These 3 negative affective states/specific affective states or constructs can be present both in normal life conditions and in clinical situations, the difference is given by their severity (Lovibond et al., 2011). We considered it important to assess these variables because they can influence the stress level of the organism. Table I presents the data obtained from the statistical processing of the DASS-21R results, where statistically significant

changes are observed in all three categories of HWC post-intervention specific effects, which are visible in both maximum and median levels.

**Table I**  
Statistical parameters obtained after processing of the DASS-21R results.

Specific effects	Initial moment T1/ Final moment T2	Range (min-max)	Median	p-value
Depression	T1	0 - 22	9	0.0301
	T2	0 - 18	5	
Anxiety	T1	0 - 22	6	0.0096
	T2	0 - 12	2	
Stress	T1	0 - 34	13	0.00264
	T2	0 - 22	8	

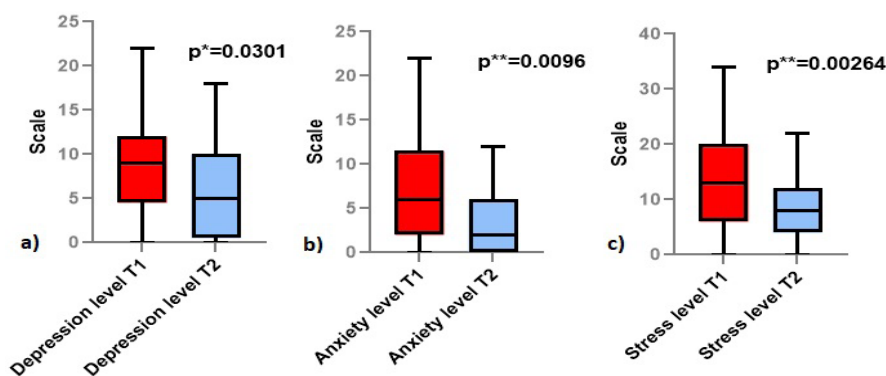
The maximum level of *depression* decreased from a severe (maximum value = 22) to a moderate (maximum value = 18) degree, according to the DASS severity classification shown in Table II. Also there was a significant decrease (p=0.0301) from the upper limit of normality (median=9) to the middle of the normal range (median=5).

**Table II**  
DASS severity classifications.

Level	Depression	Anxiety	Stress
Normal	0 - 9	0 - 7	0 - 14
Easy	10 - 13	8 - 9	15 - 18
Moderate	14 - 20	10 - 14	19 - 25
Severe	21 - 27	15 - 19	26 - 33
Extremely severe	28 - 28+	20 - 20+	34 - 34+

Regarding the *anxiety* construct, its evolution was also interesting, especially at the maximum level, where it decreased from extremely severe (maximum value = 22) to moderate (maximum value = 12). The decrease is significant (p=0.0096), from a degree close to the maximum limit of normality (median=6) to a degree of normality closer to 0 (median=2), more precisely very close to a lack of anxiety.

In the case of perceived *stress*, the maximum level also had the same favorable evolution, decreasing from an extremely severe degree (maximum value=34), to a moderate degree (maximum value=22), with a significant reduction (p=0.00264), from a degree of normality closer



**Fig. 1** – The three specific effects level at the two time points T1/T2: a) Depression b) Anxiety and c) Stress.

to the maximum limit (median=13) to a normality closer to the middle of the range (median=8).

Thus, all three specific effects/negative affective states/constructs or syndromes had a statistically significant favourable evolution ( $p < 0.05$ ), the most significant being the level of perceived stress (c), followed by anxiety (b) and depression (a), as shown in Fig 1.

On the whole, there is a statistically significant ( $p=0.027$ ) downward trend in the three specific effects/negative affective states that can influence the body's stress level (Fig.2).

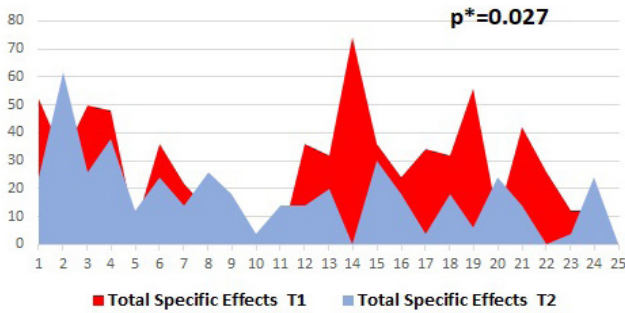


Fig. 2 – The total specific effects for each subject at T1/T2.

The QOLI questionnaire is a method of measuring satisfaction with life, which includes 32 items from 16 areas of life, as follows: health, self-esteem, goals and values, money, work, play, learning, creativity, help, love, friends, children, relatives, home, neighborhood and community (Frisch & Livinți, 2014). QOLI showed its

usefulness for this research as it proved to be beneficial in evaluating the initial results, as we were able to direct the focus of the HWC intervention on the most affected areas. It also proved to be a valuable tool in the assessment of the intervention outcomes, for, even if the statistical data obtained (presented in Table III) were insignificant ( $p=ns$ ), improvements could be observed in all three values: minimum, maximum and median.

The minimum value increased from -1.1 to -0.4, remaining at the same very low level according to Table IV, the maximum value increased from 4.3 to 5.4, both representing a high level, and the median value followed the same pattern of increase from 2.6 to 3.25, being stationary at the average level.

**Table IV**  
The level of global quality of life - raw scores.

The level of global quality of life	Range of raw scores
High	3.6 - 6
Medium	1.6 - 3.5
Low	0.9 - 1.5
Very Low	-6 - 0.8

As shown in Fig. 3, there is a slight increase in the level of quality of life in the raw score parameter (a), obtained following the intervention, and in the overall quality of life parameter (b), there is a flattening of those with a very low level, together with a decrease in the number of those with a low and medium quality of life, in favour of an increase in those with a high quality of life.

**Table III**  
Statistical parameters obtained after processing of the QOLI results.

Life quality	Initial moment T1/ Final moment T2	Range (min-max)	Median	p-value	
Raw score	T1	-1.1 - 4.3	2.6	ns.	
	T2	-0.4 - 5.4	3.25		
Global life quality		Very low (%)	Low (%)	Medium (%)	High (%)
	T1	12.5	8.33	50	29.17
	T2	12.5	4.17	45.83	37.5

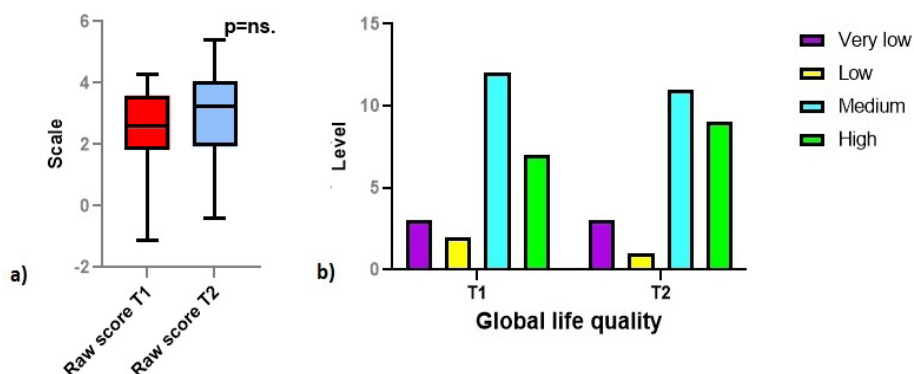


Fig. 3 – The life quality level at the two time points T1/T2: a) Raw score and b) Global life quality.

**Table V**

Statistical parameters obtained after processing of the DC results.

Parameters of decision capacity	Moment	Range (min-max)	Median	p-value		
Raw score	T1	1 - 8	4.5	ns.		
	T2	2 - 10	4.5			
Global decisional level		Very low (%)	Low (%)	Medium (%)	High (%)	Very high (%)
	T1	4.17	33.33	33.33	20.83	8.33
	T2	0.00	37.50	29.17	20.83	12.50

In terms of decisional capacity (DC), the results presented in Table V support statistically insignificant changes, with small variations in the values of the minimum and maximum scores, and a stagnation of the median value at T2 compared to T1.

The minimum score increased from 1 to 2, which represents a leap to a higher level for both women and men, as shown in Table VI, from extremely low to low, whereas the maximum score evolved from 8 to 10, remaining in the same category of a very high level regarding men and representing a leap to a higher category from high to very high regarding women 30+.

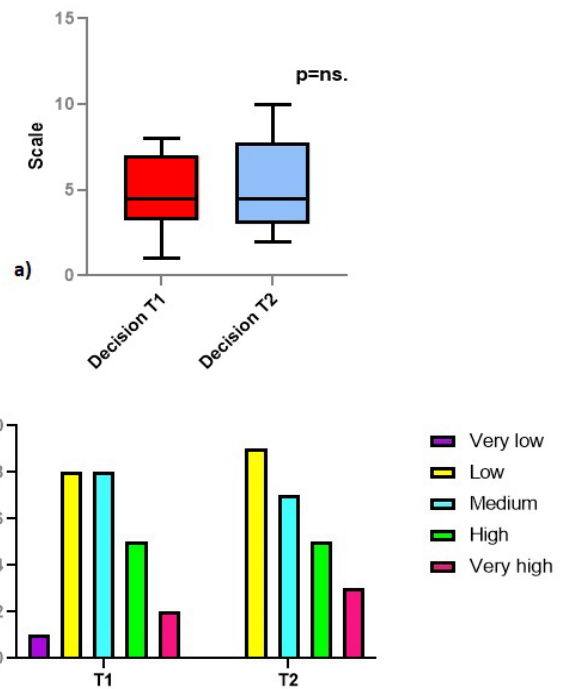
**Table VI**  
Standard of decision capacity.

Description	Very low	Low	Medium	High	Very High	
Age (years) Class/Level	1	2	3	4	5	
Masculine	19 - 29	0 - 1	2 - 3	4	5 - 7	8 - 14
	30 - 40	0 - 1	2 - 3	4 - 5	6 - 7	8 - 14
	40 +	0 - 1	2 - 3	4 - 5	6 - 7	8 - 14
Feminine	19 - 29	0 - 1	2	3 - 5	6 - 7	8 - 14
	30 - 40	0 - 1	2 - 3	4 - 5	6 - 8	9 - 14
	40 +	0 - 1	2 - 4	5 - 7	8 - 9	10 - 14

Fig. 4 shows a favorable evolution of both the decisional capacity regarding the raw score (a), even if statistically insignificant ( $p=ns$ ), and of the overall quality of decisional capacity (b). It is interesting to note that at time T2, the very low decision-making level category disappeared, with an increase in the number of those at the low level, the medium level also decreased in parallel with the increase in those at the very high level, and the high level remained stationary. It is worth noting that the very low level disappeared and the very high level increased.

Using near-infrared spectroscopy (fNIRS), we aimed to detect changes in local brain blood flow and oxygen levels in response to neural activation. The Mendi headband, equipped with fNIRS sensors (three optodes - two channels) was placed above the forehead where the anterior prefrontal cortex (A-PFC) is located, specifically the Brodmann area (BA10), with a key role in executive functions. Measurements were performed in a quiet isolated space with natural light and a temperature of 24 Celsius degrees, after subjects had previously relaxed for 5 minutes, with their eyes closed, in a seated position

on a chair. They then focused for 5 minutes on a mental task from the Mendi app located on the tablet or mobile phone in front of them, and then we recorded oxygenated blood flow in response to neural activity in the anterior prefrontal cortex. Through this measurement we attempted to identify the existence of baseline variables (T1) specific for a high level of perceived stress, as well as the presence of statistically significant changes in the post-intervention parameters. The results are shown in Table VII.



**Fig. 4** – The decision capacity level at the two time points T1/ T2: a) Raw decision score and b) Global quality of decisional capacity.

**Table VII**

Statistical parameters obtained after processing of the fNIRS results.

Parameters	Moment	Range (min-max)	Median	p-value
Neural activity	T1	4-50	20	0.0022
	T2	4-34	12	
Control	T1	9-57	22	ns.
	T2	6-66	17	
Resilience	T1	259-5503	1724	0.00463
	T2	215-4596	1152	

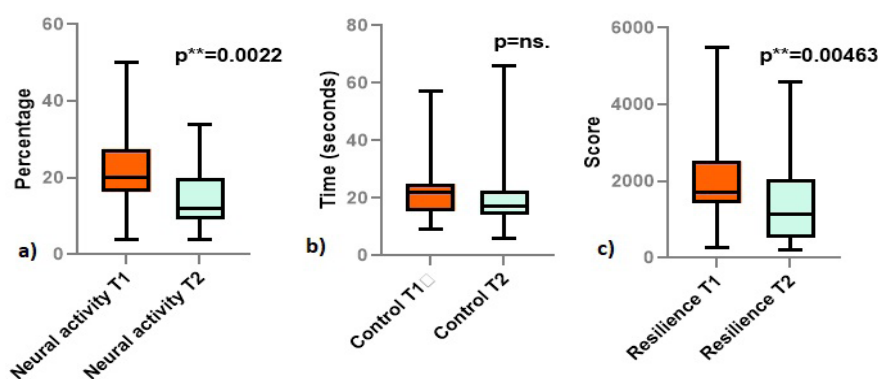


Fig. 5 – The brain activity level at the two time points T1/T2: a) Neural activity, b) Control, c) Resilience.

These show a significant decrease ( $p = 0.0022$ ) in neural activity in the area A-PFC from 20% to 12%, in parallel with a significant decrease ( $p = 0.00463$ ) in resilience from 1724 to 1152 points, defined here as the total increase in neural activation during the 5-minute session. For the control parameter, in this case defined as the longest period of sustained brain activation without interruption, we also show a median decrease from 22 to 17 (Fig. 5). No significant changes were observed in the control parameter.

The important aspect taken into account by this assessment was the response of the brain following the HWC intervention, as by this we aimed to produce functional and/or structural changes in the brain, as it is endowed with the capacity for neuroplasticity.

## Discussions

In this study, using the HWC intervention, we focused on conditioning factors which could favorably influence both specific and non-specific responses, i.e. the stress level of the organism. Enrolling subjects in this research was a great challenge given the overall circumstances of widespread distrust of any type of intervention, test collection etc. but being an online research, acceptance was facilitated somewhat. Eventually, once the interventional procedure was started, the subjects changed their initial state relatively quickly, being guided and empowered to take responsibility for their condition and actions. The majority of the objectives were achieved, and this had a strong impact on the levels of perceived stress and general well-being. Also, everybody realised and understood what stress was, which was the difference between stress, distress and eustress and how distress could affect their overall well-being and health. Learning the information through training was an important step in their positive development, as it completely changed their perspective. They became aware of the triggers/stressors that were driving them into the automatic/reactive zone, and were able to block them and then change their meaning or mental representation, thus making them lose their role of „triggers”. According to Ellis, a stimulus does not directly cause a response, but it generates it through the organism, that specific human biosocial structure, in other words stress per se does not have an independent existence of its

own (Ellis et al., 2020). Therefore the significance of an event in the environment is constructed by each individual, so an event only becomes stressful if that person considers it stressful (Klarreich, quoted by Ellis et al., 2020). Also, they unanimously supported the role of conscious breathing throughout the whole transformation process.

The results obtained following the HWC intervention, in particular the significant favourable evolution of the three *negative affective states* or specific effects (Fig.1), may lead us to the idea that the psychological construct of ‚stress”, having the strongest variation, is the most flexible or easily influenced parameter by this type of intervention, followed by ‚anxiety” and ‚depression”. Regarding the construct „depression” we may conclude that it represents a more severe degree of psycho/mental/emotional distress, which requires a closer look, and probably a higher number of training and/or coaching sessions, as it could generate distress more easily. We also think it is important to promote the real concept of biological „stress”, more precisely the *nonspecific effects* common to all living organisms, because these are the ones that, when exceeding a certain threshold value, can degenerate into organic diseases. Organ- or system-specific effects due to organ-specific stimuli are definitely important, as they can in turn influence the level of stress in the body. As mentioned earlier in the paper, specific effects at the psychological/mental/emotional level are much more evident in humans compared to other species, as we have the most sophisticated central nervous system, and if these are dysfunctional, they can have a strong negative impact on stress levels in the body. Therefore, we believe that their assessment is important in practice because it can give us useful information about the psycho/emotional/mental state, which can alter the level of stress in the body. At the same time, it is vital to have another name for the psychological construct ‚stress”, which is actually a specific effect/affective state located at the level of the central nervous system, because it generates major confusions that benefit neither specialists nor the general population.

We also realized that the QOLI tool proved its practical usefulness especially at T1, in assessing the initial situation, because we could thus direct the HWC intervention on the most affected areas of *satisfaction with life*. The evolution



of the subjects was favourable, even if the overall total score sometimes did not change or increased insignificantly. This indicates a reorientation and perhaps a different perception of certain areas of the subjects' lives, which gave them a sense of well-being and satisfaction.

The evolution of the *decisional capacity* was also interesting, for, even if it was statistically insignificant, the fact that the very low level of decision-making disappeared and the very high level of decision-making increased was quite remarkable. The test (DC) used in this research assessed the decisional rationality or a person's sensitivity to decisional biases and heuristics. A high score denotes low sensitivity and a low score denotes high sensitivity to common heuristics and decision biases, with a tendency to miss relevant information, relying more on intuition (Miclea et al., 2009). Attentional bias, or the tendency of a person to preferentially process certain stimuli, is according to some experts a consequence of anxiety. They also talk about a reduced capacity for attentional control that can lead to an imbalance, in the sense of modifying certain characteristics of environmental stimuli, especially dangerous ones (Eysenck et al., 2007). Therefore, these people are more likely to have a tendency to interpret uncertain stimuli or situations negatively. In the future it would be interesting to study whether rational or intuitive choices predominate in everyday life and what the advantage or disadvantage of those choices would be on the general well-being and the quality of life of individuals.

The assessment of *neural activity* was conducted in order to understand and identify the existence of links between stress, the decisional capacity and the quality of life. We used fNIRS technology, mainly due to its robustness, portability and commercial affordability. Using it, one can measure the link between local neural activity and associated hemodynamic responses, as well as calculate relative levels of brain physiological parameters such as oxygen levels (Soekadar et al., 2021). The rationale behind fNIRS technology is that changes in brain oxygen consumption increase with synaptic activity in a linear fashion. Laboratory fNIRS devices are used with good results especially for hemodynamic activity in prefrontal areas, important for executive function, impulse control, emotion regulation and planning etc. (Högman & Dravniknes, 2024).

Some studies have shown a strong link between the anterior prefrontal area (BA10) investigated by us with the help of the Mendi device and decision-making processes. For example, individuals with an impairment in this area show poor decision-making and social skills (Lew & Yadav, 2024). Also, through its connections with limbic structures, it provides the anatomical basis for prefrontal control over emotional and motivational states (Petrides & Pandya, 2007). Intriguingly, this area has also been observed to be involved in decision making before the decision is available for conscious awareness, and thus predictive neural information from the BA10 region precedes the conscious motor decision by up to 10 sec. Basically, this area is involved in storing conscious action plans and changes in strategy following negative feedback (Soon et al., 2008).

According to the results obtained from the

measurements, we consider that the decrease in neural activity in the area (BA10) is a good sign and demonstrates that using the HWC training the subjects gained conscious control of their states and actions, helped by the positive feedback provided in the coaching sessions, and combined with the conscious breathing techniques acquired. We consider that those unconscious automatic, predictive actions, or irrelevant motor programs were reduced at T2 compared to T1 due to the accumulation of evidence about the features of the relevant stimuli, evidence that in the first phase (T1) was not perceptible to them.

During the intervention, due to mental training and knowledge accumulation, they were able to reinterpret the „triggers” or stressors, thus gaining conscious control over negative affective states. As a result, the automatic activation of neurons in the BA10 area was significantly reduced, by significantly reducing unconscious reactions, and the energy saved is probably redistributed to other areas of the brain, but this information is the subject of future research. In the same decreasing direction, similar to *neural activation, resilience*, expressed by the maximum total level of neural activation, and *control* level also evolved, even if its evolution was insignificant.

Overall, the impact of the HWC intervention was evidenced by a reduction in perceived stress/negative affective states, in parallel with significant changes in brain hemodynamics, virtually a redistribution of blood flow between the brain areas, along with an improved quality of life and more conscious/inspired decision-making. Subjects were then monitored post-intervention, quarterly, by telephone/wp, just to confirm the continuing favourable personal development. The personal benefit was immense, while the risk of this type of intervention was zero.

Given that there is an ongoing need to find new models of care to improve the quality of life and well-being of individuals, in and outside of a formal medical setting, HWC has proven to be a promising and cost-effective approach (Perlman & Dabrh, 2020).

## Conclusions

1. Regarding the present research, the post-intervention assessments (HWC) showed a reduction in the levels of perceived stress, correlated with changes at the physical and cerebral levels, an improved quality of life of subjects and more inspired decisions, which proves that it can be successfully applied in the prophylaxis of chronic diseases commonly associated with stress.

2. The DASS-21R has proven to be a useful tool both in the initial assessment to determine the degree of psycho/emotional/mental impairment and in the evaluation of the HWC intervention, with the only amendment on the renaming of the construct of „stress”.

3. QOLI was a particularly useful tool at T1 moment, directing the focus of the intervention to the most affected areas. However, perhaps a more extensive period of individual training afterwards is needed for achieving significant changes in the quality of life.

4. The fNIRS technology provided us with interesting information, regarding more the intervention assessment side. As there are no standardised data for stress levels, it cannot be used as a tool to detect high stress levels. Since

the Mendi device has a rather small brain level information collection area (BA10), further studies are needed in order to draw a conclusion.

5. Early detection of high levels of stress is becoming a global priority on account of the high rate of morbidity and mortality due to chronic diseases, and these promising results help us to be optimistic about the future. An interesting direction for further research in the field of stress would be molecular level assessments to identify microRNAs (miRNAs) that could become pathognomonic epigenetic markers for stress.

### Conflict of interests

The authors declare no conflicts of interests.

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### References

- Ellis A, Gordon J, Neenan M, Palmer S. *Terapia stresului. O abordare comportamentală rațional-emoțională.* (Stress Counselling: A Rational Emotive Behaviour Approach). Ed Trei. București, 2020,13.
- Eysenck MW, Derakshan N, Santos R, Calvo MG. Anxiety and cognitive performance: Attentional control theory. *Emotion.* 2007;7(2):336-353. doi: 10.1037/1528-3542.7.2.336.
- Frisch MB, Livinți R. Formular de răspuns pentru scorare manuală. Manual și ghid de tratament, QOLI-Quality of Life Inventory, Inventarul Calității Vieții. O.S.Organizzazioni Speciali. București, România, 2014a. Available on-line: <https://testcentral.ro/test/quality-of-life-inventory>.
- Frisch MB, Livinți R. Introducere și prezentare generală. Manual și ghid de tratament, QOLI-Quality of Life Inventory, Inventarul Calității Vieții. Cap I, O.S.Organizzazioni Speciali. București, România, 2014b, 13.
- Hacker K. *The Burden of Chronic Disease.* Elsevier Inc on behalf of Mayo Foundation for Medical Education and Research. *Mayo Clin Proc Innov Qual Outcomes.* 2024;20;8(1):112-119. doi: 10.1016/j.mayocpiqo.2023.08.005.
- Högman L, Dravniknes H. Validation of a consumer-grade functional Near-Infrared Spectroscopy device for measurement of frontal pole brain oxygenation - an interim report. Available online at: [https://mendi-webpage.s3.eu-north-1.amazonaws.com/Mendi\\_signal\\_validation\\_interim\\_report\\_final.pdf](https://mendi-webpage.s3.eu-north-1.amazonaws.com/Mendi_signal_validation_interim_report_final.pdf). Accessed on 2024, April 20.
- Hwang Y, Oh J. Relationship between depression, anxiety, stress, and health-related quality of life in adults with and without chronic diseases: A cross-sectional study. *Medicine (Baltimore).* 2024; 103(2): e36967. doi: 10.1097/MD.00000000000036967.
- Klarreich. *Terapia stresului. O abordare comportamentală rațional-emoțională.* In Ellis A, Gordon J, Neenan M, Palmer S. Ed Trei, București, 2020, 13.
- Lew CH, Yadav A. Frontal cortex area 10 cytoarchitecture. Available online at: <https://carta.anthropogeny.org/moca/topics/frontal-cortex-area-10-cytoarchitecture>. Accessed on 2024, May 3.
- Lovibond SH, Lovibond PF, Pețe A, Albu M. Anexa 3 - Itemii DASS 21-R. DASS. Manual pentru Scalele de depresie, anxietate și stres. Adaptare și standardizare pe populația din România. Edt ASCR, Romania, Cluj-Napoca, 2011. Ed în limba română. Edit Diana Breaz. SC Cognitron SRL. Cluj Napoca, 2011, 31, 32, 63.
- Mariotti A. The effects of chronic stress on health: new insights into the molecular mechanisms of brain-body communication. *Future Sci OA.* 2015;1(3): FSO23. doi.org/10.4155/fso.15.21.
- Miclea M, Cotârlea P, Porumb M, Albu M. CAS++ Cognitrom Assessment System CAS++. Ed a 2-a, Edt ASCR Cluj-Napoca. *Aptitudini cognitive. Capacitatea decizională,* 2009, 614, 615.
- Perlman AI, Dabrh AMA. *Health and Wellness Coaching in Serving the Needs of Today's Patients: A Primer for Healthcare Professionals.* *Glob Adv Health Med.* 2020;9:2164956120959274. doi: 10.1177/2164956120959274.
- Petrides M, Pandya DN. Efferent Association Pathways from the Rostral Prefrontal Cortex in the Macaque Monkey. *J Neurosci.* 2007;27(43):11573-11586. DOI: doi.org/10.1523/JNEUROSCI.2419-07.2007.
- Pittella JEH. The uniqueness of the human brain: a review. *Dement Neuropsychol.* 2024;18:e20230078. doi: 10.1590/1980-5764-DN-2023-0078.
- Selye H. *Definition and Terminology of Biologic Stress, Stress in health and disease,* 1st Edition - January, Butterworth Inc USA. 1976, Library of Congress Catalog, Vol 1,15,16, 24.
- Singh A, Arora M, Sharma V, Kotwal A. Stress: Prevalence and correlates among residents of a suburban area. *Ind Psychiatry J.* 2019;28(1):98-102. doi: 10.4103/ipj.ipj\_33\_18.
- Smith K, Hays L, Yen L, Wolever RQ. Effects of Health and Wellness Coaching With an Adult Cancer Caregiver. *Perm J.* 2022;26(2):118-125. doi: 10.7812/TPP/21.227.
- Soekadar SR, Kohl SH, Mihara M, Von Lümann A. Optical brain imaging and its application to neurofeedback. *Neuroimage Clin.* 2021;30:102577. doi: 10.1016/j.nicl.2021.102577.
- Soon CS, Brass M, Heinze HI, Haynes JD. Unconscious determinants of free decisions in the human brain. *Nature Neurosci.* 2008;11:543-545. doi:10.1038/nn.2112.
- Stoffel M, Gardini E, Ehrental JC, Abbruzzese E, Ditzel B. Evaluation of Stress Management and Stress Prevention Using Epigenetic Markers. *Verhaltenstherapie.* 2022;32(Suppl.1):5-13. doi.org/10.1159/000506323.

### Websites

- (1) World Medical Association, Declaration of Helsinki – Ethical principles for medical research involving human subjects. Available online at: <https://www.wma.net/policies-post/wma-declaration-of-helsinki-ethical-principles-for-medical-research-involving-human-subjects/>. Accessed on 2024, May 10.
- (2) Cognitron. Platforma computerizată de evaluare psihologică (CAS++). Available on-line at: <https://www.cognitrom.ro/produs/evaluare-psihologica/>. Accessed on 2024, May 5.
- (3) The science behind Mendi. Available on-line at: <https://www.mendi.io/pages/science>. Accessed on 2024, May 10.