Autonomic arousal and differential diagnosis in clinical psychology and psychopathology

La valutazione della risposta neurovegetativa nella diagnosi differenziale in psicologia clinica e psicopatologia

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Summary

Aim

To confirm the presence of typical autonomic response associated to distinguished psychopathological conditions.

Methods

A sample of 60 subjects (Table I) was consecutively examined in an outpatient clinical center with the following diagnoses according to the DSM-IV-TR criteria [1]: Generalized Anxiety Disorder (GAD, n = 24), Major Depression Episode (MDE, n = 14), Panic Disorder (PAD, n = 12), Obsessive-Compulsive Disorder (OCD, n = 10).

Inclusion exclusion criteria: subjects with physical illness or comorbidity with other I or II axis disorders of the DSM IV were excluded. At the time of diagnosis, all the subjects had been free of any medication for at last of three months.

All the subjects underwent a continuous and simultaneous registration of four physiological parameters strictly connected with autonomic arousal (psycho-physiological profile or PPP): skin conductance response (SCR), heart rate (HR), peripheral temperature (PT), and electromyography of the forehead muscle (EMG). All the parameters were continuously registered in three consecutive phases: baseline (registration at rest), stress presentation, and recovery. Each phase lasted 6 minutes, with a stop of 10 seconds between the phases as well as 3 minutes of adaptation before the start of the registration.

Data from the four groups of subjects regarding each of the registered physiological parameters were compared by using the mean value of the last minute of the registration at rest, and two activation indexes: "response to stress" and "recovery after stress." The Kruskal-Wallis (Table IV) and Mann-Whitney (Table V) statistical tests were utilized to evaluate differences between groups. Furthermore, for each physiological parameter and for each diagnostic group, the mean values of the three different phases (last minute of the rest, first minute of the stress, and last minute of the recovery) were compared in order to evaluate trends in the four PPP parameters. Friedman and Wilcoxon's statistical tests (Table III) were utilized to evaluate possible differences among the three phases, and the significance of the changes that occurred between one phase and the others.

Results

Results from the statistical analysis showed that SCR mean values are much higher for GAD and PAD patients than for MDE and OCD ($p < .001$). The amplitude of the galvanic response was also significantly different ($p < .05$; Fig. 1). Furthermore, the HR response was higher in GAD than in the other three groups ($p < .02$). Therefore, OCD and MDE patients seem to be characterized by a low, stable profile of all the considered parameters.

Conclusions

The results confirm the relevance of the psycho-physiological evaluation as part of a multidimensional diagnosis in clinical psychology and psychopathology, partially in accordance with the Gray and Fowles model. Furthermore, obtained data suggest the interesting hypothesis that the PPP may be used as a new tool for differential diagnosis, such that some psychopathological syndromes would be represented not only by a single measure (such as skin conductance which is recommended in the DSM-IV-TR only in regard to anxiety disorders), but by a specific and typical autonomic response pattern.

Key words

Psychophysiology • Differential diagnosis • Psychopathology

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Introduction

The multidimensional approach to a clinical psychological diagnosis presumes the collection of data coming from different response systems or "channels" (i.e. from verbal, motor, cognitive and psycho-physiological systems). This last "channel" is represented by indices such as muscle tension (EMG), heart rate (HR), electrodermal activity (SCL, SCR, or GSR), and peripheral temperature (PT), that are linked to one's stress response and, more generally, to autonomic arousal. Traditional experimental and clinical studies in psychology and psychopathology are rich in works and discoveries pertaining to the area of psycho-physiology. Among the more significant research of the past years, some of the most interesting is that of Gray [2] – pursuant to the experimental contributions of Fowles [3 4] – for its impact on the clinical environment as well as for its application in clinical evaluations and in different phases of treatment.

According to this approach, increases in heart rate and electrodermal activity are physiologically correlated, respectively, to the Behavioral Activation System (BAS) and the Behavioral Inhibition System (BIS). The BAS is comprised of dopamine pathways that include the ventral tegmental area and the nucleus accumbens. It is activated by discriminative stimuli associated principally with positive reinforcers, but also with negative reinforcers connected to pleasant events, and the BAS regulates appetitive behavior and fight-or-flight behavior. The BIS is comprised of a net of neural structures that include the amygdala and the septal-hippocampal systems, which receive serotonin afferents from the raphe nuclei and noradrenalin afferents from the *locus coeruleus*, projecting efferents to the frontal lobe. It is activated by discriminative stimuli principally associated with punishment or the suspension of reinforcement, and the B.I.S. mediates the approach-avoidance conflict with consequent behavioral blocking and the appearance of defensive, passive avoidance behavior.

Among the techniques used to evaluate the influence of autonomic arousal responses on behavior, there is the Psycho-Physiological Profile (PPP) which consists of the simultaneous registration of several physiological parameters. The parameters most frequently utilized are electromyography of the frontal forehead muscle (EMG), peripheral temperature (PT), heart-rate (HR), and galvanic skin response (GSR). Such registration is generally subdivided in three consecutive phases: registration at rest, stress-presentation, and recovery [5-9].

In the course of the initial phase ("rest") and the last phase ("recovery"), in which there is an absence of stimulation, a baseline for autonomic activity is recordered. Meanwhile, the intermediate phase ("stress") aims to elicit a physiological response through the administration of one or more "activating" stimuli or by asking the participant to carry out a task. Among these tasks, one of the most simple and diffused is the Mental Arithmetic Task (MAT) that consists of subtracting a number (i.e. 13) from a higher, four-digit number (i.e. 1007) and of then continuing to repeat the operation on every resulting number that is obtained [6]. To the same aim, problem-solving, logical reasoning, or analytic reasoning tests can also be employed. Among the last of these, the computerized version of Raven's Progressive Colored Matrixes (CPM 47) offers the additional benefit of overcoming the possible inconveniences that are inert to the administration procedures and the role of the examiner [10].

The aim of an evaluation such as the PPP is that of verifying if, how, and how much the psycho-physiological equilibrium demonstrates maladjusted responses, on the basis of the following observations:

- verification of an elevated level of autonomic activation for one or more parameters during the "rest" phase;
- slow, inconsistent, or absent response values for one or more parameters during the "rest" phase;
- abnormal amplitude of the stress-induced activation response, observable in one or more parameters during the "stress" phase;
- slow, inconsistent, or absent modification of the response values for one or more parameters during execution of the mental task ("stress" phase);
- slow, inconsistent, or absent restoration of baseline response values for one or more parameters during the "recovery" phase.

Diverse clinical psychology studies have demonstrated the possibility of identifying physiological correlates to several psychopathological syndromes. Among these, Stegagno e Palomba [11] have confirmed the presence of particular psycho-physiological profiles in relation to the presence

of anxiety and depression. Such findings had been previously described in research carried out by Lader [12 13] as well: an anxiety syndrome, for example is characterized by elevated heart rate, muscle tension, and electrodermal activity response levels and by a decrease in peripheral temperature. On the other hand, depressive profiles are distinguished by elevated levels of heart rate and muscle tension, but by low electrodermal activity (level and response).

Additional research [14-19] found low skin conductance levels (SCL) in depressed patients during registration at "rest," in comparison to a control group. Scare SCL reactivity in depressed participants was also tested through guided imaginative exposure techniques [17].

Patients with Panic Disorder (PAD) [9] showed a profile characterized by hyperactivation that overlapped in part with the profile identified in anxious participants who had been previously studied in cited works by Lader [12 13]. Those participants had been characterized by elevated baseline levels of forehead electromyography activity, of systolic blood pressure, and of heart rate, and lesser spontaneous electrodermal activity in respect to healthy participants. More recently, Wilhem, Trabert & Roth [19] verified that PAD patients presented an autonomic activation at rest that is distinguishable from the activation trends of patients with Generalized Anxiety Disorder (GAD) and of a control group; if only on the basis of the respiratory parameters. Furthermore, there are several scientific contributions that have always found a typical and elevated SCL at rest in patients with PAD [20-25]. In addition, always on the basis of skin conductance, PAD participants have demonstrated a low habituation to neutral stimuli and a scarce capacity to relax [20 21 26].

On the other hand, a pattern of reduced autonomic activity at rest was observed in patients with Obsessive-Compulsive Disorder (OCD). This pattern was expressed through reduced levels of skin conductance, heart rate, and electromyography activity [27-29]. Finally, skin conductance was also shown to be predictive of possible symptom reduction in pharmacological trials [30 31].

The aim of the present study is to test, through the use of the PPP and on the basis of the trends of four PPP parameters, autonomic activation schemes characteristic of subjects with anxious, depressive, obsessive-compulsive, and panic disorder symptomatology.

Materials and method

An evaluation of 60 patients' autonomic state and autonomic activation response was carried-out through the registration of a psycho-physiological profile (PPP). The sample was composed of 29 males and 31 females between the ages of 27 and 51 years (mean age = 38,4 ± 9,7) and was subdivided into the following four groups, which correspond with four different psychopathological conditions evaluated according to DSM-IV-TR criteria [1]: Generalized Anxiety Disorder (GAD), Major Depressive Episode of a moderate degree (MDE), Panic Disorder (PAD), and Obsessive-Compulsive Disorder (OCD; Table I). At the time of the psychophysiological registration, none of the participants had been undergoing pharmacological treatment for at least three months. Participants with concomitant organic syndromes and/or comorbidity with other DSM-IV Axis I or II disorders were excluded. The PPP was subdivided into in the following four phases:

- "adaptation" (5 minutes): The patient is made comfortable in a room equipped with electronic devices for automatic temperature control (maintained between 18 and 22° C), and humidity control (maintained at lower that 50% with the appropriate extractor apparatus). The patient was seated in a recliner armchair with a headrest and wide armrests. The patient was then informed of the content and the significance of the procedure and was reassured about the non-invasive and harmless nature of the procedure. Meanwhile a psychologist positioned the electrodes and transducers, set up the registration equipment, and monitored the trends of the different physiological parameter values, waiting for them to stabilize;

TABLE I.
Characteristics of the examined sample. *Caratteristiche del campione.*

	Number of participants	
	Males	Females
GAD	8	16
PAD	9	3
OCD	7	3
MDE	5	9
Total	29	31

- "rest" (6 minutes): The registration began after the patient had been instructed to close his/her eyes, to remain still, to relax as much as possible, and to signal any possible problems (i.e. the need to cough) by raising the index finger of his/her right hand in order to momentarily interrupt the registration;
- "stress" (4 minutes): The participant was asked to complete a mental task consisting of subtracting the number 13 from 1007 (MAT) and then continuing to subtract 13 from every resulting number obtained (serial subtraction);
- "recovery" (6 minutes): At the end of the stress presentation, the patient was told to cease carrying out the mental task and to rest and relax as much as possible.

During the PPP, the following physiological parameters were registered:

- electromyography of the forehead muscle (EMG): The electric potential is detected through two active electrodes positioned approximately 1 cm above the eyebrows in alignment with the pupils, and one reference electrode on the center of the forehead (distance between the two active poles was approximately 2,5 cm);
- heart rate (HR): The electric potential of the cardiac muscle was detected with the classic bipolar derivation for an electrocardiogram, and the elapsed time between one R wave (ventricular contraction) and another was calculated by means of electrodes positioned in the precordial area;
- peripheral Temperature (PT). PT was measured by applying a Termistor at the base of the thenar eminence of the dominant hand;
- galvanic skin response (GSR). GSR was detected by passing an electric current of extremely low intensity between two electrodes positioned on the last phalanx of the fingers of the dominant hand (in this case the index and middle fingers).

EMG and HR signals were detected using single surface electrodes. Reusable gilded electrodes were employed for the GSR signals, and a precision Thermistor was applied for PT. The signals were monitored and stored through the appropriate software.

Statistical Analysis

Mean values for the four considered parameters were calculated over the following periods:

- the last minute of the "rest" phase, after the stabilization of the values, as a measure of baseline activation;
- the first minute of the "stress" phase as a measure of one's state of activation while carrying out of the mental task, (measured with the intention to exclude habituation phenomenon interference that could allow for an underestimation of the amplitude of the activation);
- the last minute of the "recovery" phase as a measure of the level of activation at the end of the procedure in order to verify the extent to which a participant returns to the baseline activation values after a reasonably sufficient period of time.

Two indices were calculated in order to compare the patient groups in regard to the trends found in the four parameters across the three phases. These following indices were calculated on the basis to which they were suggested by Arena & Blanchard [32]:

- *response to stress*, as an indicator of the amplitude of the autonomic activation response. It was calculated by subtracting the mean value from the last minute of the "rest" phase from the mean value of the first minute of the "stress" phase;
- *recovery after stress*, as an indicator of the amplitude of recovery from the state of autonomic activation. It was calculated by subtracting the mean value of the last minute of the "recovery" phase from the mean value of the entire "stress" phase (considering, therefore, the mean of the entire four minutes).

The non-normal distribution of the data was controlled for with the Shapiro-Wilks test and non-parametric statistical analysis procedures were employed. Foremost, a comparison was carried out among the four patient groups, taking as points of reference the mean value of the last minute of the "rest" phase, and the calculated indices "response to stress" and "recovery after stress." This comparison was carried out by means of the non-parametric statistical tests of Kruskal-Wallis to identify *in primis* possible differences between one or more groups and the remainders, and subsequently by the Mann-Withney statistical test, to verify significant "pair" comparisons among the groups. Separately for every group, the average values of three periods (last minute of the "rest" phase, first minute of the "stress"

phase, and last minute of the "recovery" phase) and of the three phases ("rest," "stress," and "recovery") of the registration were then compared. Friedman's non-parametric statistical tests were thus employed to the aim of identifying possible differences among the three phases and Wilcoxon's statistical tests were employed to evaluate the significance of the changes from one phase to another.

Results

Descriptive Statistics

Reported in Tables IIa and IIb are the data relative to the mean (M) and standard deviation (SD) of the four parameters registered in the three phases ("rest," "stress," and "recovery"), and of the two calculated indices ("response to stress" and "recovery after stress").

EMG

There were significant EMG results for all four groups according to the Friedman test, and significant EMG differences among some of the PPP phases (Table III). Wilcoxon's non-parametric test highlighted significant differences between the "rest" and "stress" phases, and between the "stress" and "recovery" phases in the GAD, PAD, and OCD groups. The difference between "rest"

TABLE IIA.
Descriptive statistics of all physiological indexes*. *Statistiche descrittive di tutti i parametri fisiologici**.

		GAD		PAD		OCD		MDE	
		M	SD	M	SD	M	SD	M	SD
EMG	"rest" (minute 6)	4,26	2,47	2,78	1,31	2,46	0,89	2,07	1,65
	"stress" (minute 1)	7,35	3,93	5,80	2,70	6,76	4,21	6,54	3,42
	"recovery" (minute 6)	3,98	2,26	2,44	1,12	3,22	1,55	4,83	2,80
GSR	"rest" (minute 6)	10,09	4,72	10,36	5,43	2,09	1,36	1,43	0,53
	"stress" (minute 1)	16,61	5,64	19,83	12,14	4,01	2,90	2,02	1,28
	"recovery" (minute 6)	11,70	4,92	15,16	8,44	3,43	2,11	2,47	1,35
PT	"rest" (minute 6)	31,20	3,05	31,05	3,66	31,65	2,04	30,95	2,85
	"stress" (minute 1)	30,29	2,62	30,09	3,58	31,71	2,03	30,93	2,88
	"recovery" (minute 6)	30,13	2,30	30,41	3,49	31,16	2,21	30,83	2,98
HR	"rest" (minute 6)	81,52	12,39	70,10	6,75	66,66	7,05	71,47	12,95
	"stress" (minute 1)	91,07	14,89	82,24	10,40	77,44	9,24	77,15	12,68
	"recovery" (minute 6)	81,55	13,81	70,42	5,68	67,22	4,83	73,76	14,12

* Mean (M) and Standard Deviation (SD) of registered values during "rest" (last minute of "baseline" phase); "stress" (first minute of "stress" phase) and "recovery" (last minute of "recovery" phase).

TABLE IIB.
Descriptive statistics of all physiological indexes**. *Statistiche descrittive di tutti gli indici fisiologici***.

		GAD		PAD		OCD		MDE	
		M	SD	M	SD	M	SD	M	SD
EMG	response to stress	3,09	3,68	3,03	3,04	4,30	3,83	2,77	2,51
	recovery after stress	3,37	4,12	3,36	2,95	3,54	4,33	1,71	3,05
GSR	response to stress	6,52	6,54	9,47	9,82	1,91	1,86	,59	1,03
	recovery after stress	4,91	5,60	4,67	5,17	,57	1,29	-,44	,74
PT	response to stress	,09	,60	-,07	,25	,06	,65	-,02	,11
	recovery after stress	,16	1,56	,57	,44	,55	,65	,10	,43
HR	response to stress	9,55	9,26	12,14	9,53	10,78	6,61	5,67	4,04
	recovery after stress	9,52	9,78	11,83	9,41	10,21	7,50	3,39	7,52

** Mean (M) and Standard Deviation (SD), of calculated indexes "response to stress" and "recovery after stress".

TABLE III.
Values and significance * ** of Friedman (χ^2) and Wilcoxon (W) statistical tests for the comparisons among all the physiological indexes during the three phases of PPP for each psychopathological group. *Valori e significatività * ** ai test statistici di Friedman (χ^2) e Wilcoxon (W) nel confronto tra tutti gli indici fisiologici durante le tre fasi del PPF per ogni gruppo psicopatologico.*

		Friedman test (χ^2)	"rest" (minute 6) *vs.* "stress" (minute 1)	"stress" (minute 1) *vs.* "recovery" (minute 6)	"rest" (minute 6) *vs.* "recovery" (minute 6)
EMG	GAD	22,58 (< .001)**	9 (< .001)**	17 (< .001)**	143 (n.s.)
	PAD	14,88 (< .001)**	0 (< .01)*	0 (< .01)*	5 (< .05)
	OCD	7,00 (< .05)	1 (< .02)	3 (< .05)	13 (n.s.)
	MDE	7,16 (< .05)	20 (n.s.)	18 (n.s.)	21 (n.s.)
GSR	GAD	24,25 (< .001)**	8 (< .001)**	13 (< .001)**	93 (n.s.)
	PAD	11,55 (< .005)**	1 (< .02)	0 (< .01)*	4 (< .05)
	OCD	7,00 (< .05)	1 (< .02)	10 (n.s.)	1 (< .02)
	MDE	10,5 (< .005)**	7 (< .02)	15 (n.s.)	4 (< .01)*
PT	GAD	6,58 (< .05)	140 (n.s.)	77 (< .05)	0 (< .001)**
	PAD	10,66 (< .005)**	20 (n.s.)	0 (< .01)*	0 (< .01)*
	OCD	7,00 (< .05)	12 (n.s.)	2 (< .05)	0 (< .02)
	MDE	n.s.			
HR	GAD	20,33 (< .001)**	14 (< .001)**	12 (< .001)**	134 (n.s.)
	PAD	13,55 (< .001)**	0 (< .01)*	0 (< .01)*	21 (n.s.)
	OCD	12,25 (< .002)**	0 (< .02)	0 (< .02)	15 (n.s.)
	MDE	8,16 (< .02)	1 (< .005)	19 (n.s.)	26 (n.s.)

and "recovery" emerged as significant only in the PAD group (Table III).

In the comparison among the four psychopathological groups, the Kruskal-Wallis test did not highlight any significant differences in the baseline values nor in the "response to stress" and "recovery after stress" indices (Table IV). Therefore, in the GAD, PAD, and OCD groups there is verified an increase in muscular tension following the mental task without any difference in intensity. Further, in the same patients, a nearly identical reduction of muscular tension was produced after the test and during the restoration of baseline values at the end of the procedure. Instead, the MDE group, by nature, did not show a reaction at the muscular level and the EMG parameter trend emerged as stable throughout the PPP.

GSR

There were significant GSR results for all four groups according to the Friedman test and significant GSR differences among some of the PPP phases (Table III). Wilcoxon's non-parametric test highlighted significant differences between the "rest" and "stress" phases in all four groups and between the "stress" and "recovery" phases in the GAD and PAD groups. In addition, there were significant differences between the "rest" and "recovery" phases for the PAD, OCD, MDE groups (Table III).

The Kruskal-Wallis test verified the presence of several significant differences among the four psychopathological groups on their baseline values and on their "response to stress" and "recovery after stress" indices (Table IV). In pair comparisons among the groups on their baseline values registered at rest and on the indices *response to stress* and *recovery after stress,* there emerged significant differences to the Mann-Whitney test between the GAD and PAD groups on the one hand and MDE and OCD on the other (Table V).

The autonomic activation response to the mental task was verified for all four groups, but only in the GAD and PAD patients did GSR recovery occur and in three groups of the four (PAD, OCD,

TABLE IV.
Values of Kruskal-Wallis ** statistical test (χ^2) for the comparison between all four psychopathological groups on calculated indexes for all four physiological parameters. *Valori al test statistico di Kruskal-Wallis ** (χ^2) nel confronto tra tutti e quattro i gruppi psicopatologici sugli indici calcolati per tutti e quattro i parametri fisiologici.*

	"rest" (minute 6)	Response to stress	Recovery after stress
EMG	6,13 (n.s.)	1,25 (n.s.)	2,05 (n.s.)
GSR	36,22 (< .001)**	17,21 (< .001)**	22,77 (< .001)**
PT	,68 (n.s.)	,68 (n.s.)	3,52 (n.s.)
HR	15,01 (< .002)**	3,79 (n.s.)	3,66 (n.s.)

TABLE V.
Mann-Whitney's "U" statistical test, and "p" * ** values in the comparison of all four psychopathological groups on GSR and HR baseline values and on the calculated indexes for GSR. *"U" di Mann-Whitney e valori della "p" * ** nel confronto tra tutti e quattro i gruppi psicopatologici sui valori di baseline dei parametri GSR e HR e sugli indici calcolati per il parametro GSR.*

	"rest" (minute 6) (HR)	"rest" (minute 6) (GSR)	Response to stress (GSR)	Recovery after stress (GSR)
GAD/MDE	69 (< .02)	0 (< .001)**	35 (< .001)**	30 (< .001)**
GAD/PAD	43 (< .01)*	108 (n.s.)	100 (n.s.)	104 (n.s.)
GAD/OCD	26 (< .002)**	2 (< .001)**	43 (< .05)	35 (< .01)*
MDE/PAD	46 (n.s.)	0 (< .001)**	17 (< .01)*	1 (< .001)**
MDE/OCD	39 (n.s.)	34 (n.s.)	23 (n.s.)	24 (n.s.)
PAD/OCD	22 (n.s.)	1 (< .001)**	19 (n.s.)	12 (< .05)

and DME) restoration of the autonomic baseline state was not achieved. In addition, the GAD and PAD groups distinguish themselves from MDE and OCD groups in terms of their greater general level of autonomic activation, greater magnitude of response, and higher extinction response (Fig. 1).

PT

Only the DME group lacked significant PT results to the Friedman test and significant PT differences among several phases of the PPP (Table III). For as much as regards the other groups (GAD, PAD, and OCD), the Wilcoxon test highlighted nonsignificant differences between the "rest" and "stress" phases, but significant differences between the "stress" and "recovery" phases and between "rest" and "recovery" phases (Table III). The Kruskal-Wallis verified the presence of non-significant differences among the four psychopathological groups in their baseline values and on the "response to stress" and "recovery after stress" indices (Table IV).

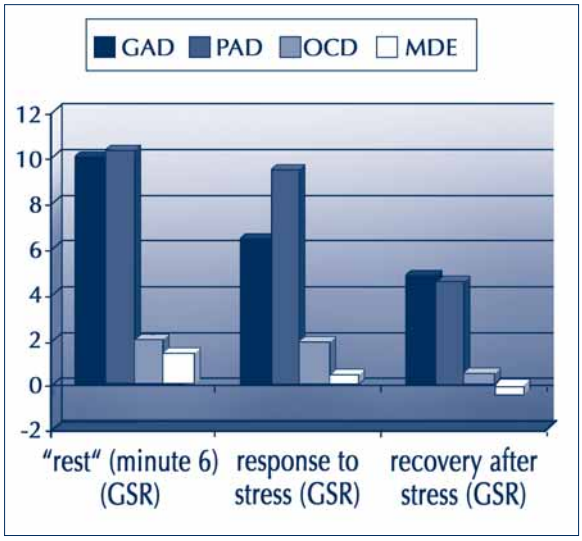

FIGURE 1.
GSR mean values at rest (baseline, B), and in the stress (S) and recovery (R) phases for the four psychopathological groups. *Valori medi di GSR nella fase di baseline (B), stress (S) e recupero (R) per i quattro gruppi psicopatologici.*

Meanwhile, the PT in MDE patients maintained itself as nearly stable for the entire duration of the procedure. In the GAD, PAD, and OCD patients, reduction of PT following the mental task was not verified; an unexpected and nearly identical PT reduction occurred after the mental task and the restoration of its baseline values did not occur.

HR

There were significant HR results for all four groups according to the Friedman test and significant differences among several of the PPP phases for HR values (Table III). The Wilcoxon test highlighted significant differences between the "rest" and "stress" phases in all four groups, between the "stress" and "recovery" phases in the GAD, PAD, and OCD groups, and finally non-significant differences between the "rest" and "recovery" phases for all of the groups (Table III). The Kruskal-Wallis test verified the presence of several significant differences among the four psychopathological groups in regard to their baseline values, but not regarding the *response to stress* and *recovery after stress* indices (Table IV). In pair comparisons among the groups, there resulted significant differences between the GAD group and the remainder in regard to the values registered at rest (Table V).
The autonomic activation response to the mental task was controlled for to the same degree for all four groups. A similar recovery was achieved in GAD, PAD, and OCD patients, while restoration of the baseline autonomic state occurred in all four groups. Finally, GAD patients differed from PAD, MDE, and OCD due to their higher general level of autonomic activation.

Discussion and Conclusions

The results of the present study further verified as much as had already been highlighted in precedent works regarding psycho-physiological parameters relation to several psychopathological syndromes [30 31], and they confirmed some of data reported in the current literature (i.e. a condition of autonomic hyper-activation in syndromes characterized by elevated levels of anxiety [12 13], and a state of hypo-activation in those patients with depressive and obsessive syndromes [11-17]). As hypothesized time ago by Fowles and Gray, the indices that proved to be the most indicative were skin conductance and heart rate, much more than muscular tension and, in part, peripheral temperature. In addition, heart rate at rest (which resulted as higher in GAD patients in respect to PAD patients), seemed capable of performing a discriminating variable role between the two syndromes. In the current literature on the topic, this role is attributed only to respiratory parameters [19]. However, the skin conductance responses found in PAD and OCD patients appeared in a manner that was consistent with the autonomic activation patterns described in the literature [19-22 24-29].
Throughout the course of the PPP, the electrodermal activation trend found in GAD, PAD, and MDE patients seems to confirm Gray [2] e Fowles [3 4] B.I.S and B.A.S. theory. The elevated baseline level, the dramatic stress response, and the incomplete recovery of the GSR parameter would reflect B.I.S. activation on the part of signals of peril or of a personal internal and/or external threat. To this aim, Roth, Wilhem, & Trabert [26] suggest that PAD patients' poor ability to relax is also indicated by the excessive spontaneous GSR fluctuation and lack of GSR recovery. GSR must be subject to the continuous attention that this type of participant dedicates to bodily sensations in an attempt to control his/her tension.
Similarly, the same GSR trend in GAD patients would reflect B.I.S. activation on the part of the internal stimuli under the form of anticipatory anxiety and performance anxiety such as fear of incurring errors during a mental task. Always in GAD patients, elevated heart rate at rest would represent B.A.S. activation associated with the excessive preoccupation, even at rest, which is typical of the anxiety syndrome.
On the contrary, in MDE patients, the reduced activation of the B.I.S. indicated by the low baseline and the weak GSR response would seem to be the psycho-physiological parameter correlated to the condition of *impotence* [33]. That is, there is a lack of active research on the discriminative stimuli associated with punishments or the suspension of reinforcers and the consequence of an avoidance behavior that, in time, always does more to impoverish one's lifestyle.
The obtained results certainly encourage continued use of this vein of psycho-physiological research. They support the necessity of further improving this research technique and of being able to integrate it efficiently with other diagnostic procedures used in psychopathology and clinical psychology.

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