Cardiometric taxonomy of stress-inducing potential in diverse domestic situations

Aleksandr S. Ognev[1*], Vladimir A. Zernov[1], Elvira V. Likhacheva[1], Lyubov P. Nikolaeva[1], Mikhail Y. Rudenko[1], Diana D. Dymarchuk[1], Denis S. Yesenin[1], Polina A. Maslennikova[1], Nikita V. Mizin[1]

[1] Russian New University
 Russia, 105005, Moscow, Radio st. 22

[*] Corresponding author:
 e-mail: altognev@mail.com

Aims

The aim of our study is to empirically verify the conceptual possibility of constructing a taxonomy of diverse domestic situations, which may become the basis for choosing the best ways to increase an individual stress resistance in a human subject.

Materials and methods

To achieve the aim, after ranking of the subjective evaluations of the occurrence rate of this sort of situations and the degree of intensity of stress induced by the situational cases, we have prepared a set of their laconic descriptions. As a result, a catalogue of 10 paired tasks has been prepared by us. One of these tasks offers that an examinee should imagine and hold in his/her memory for a certain time an image of a stress-inducing situation case as designated by the examiner. The other examinee in this pair has been instructed to imagine an alternative situation, when anticipated are a high level of the calm, trouble-free state, physical comfort and good emotional balance.

During the execution of each task, an ECG and a rheogram of every examinee have been recorded. For this purpose, the Cardiocode PC-assisted devices have been used, and the respective mathematical models of the performance of the human cardiovascular system have been applied. Upon processing of the completed cardiometric records, values of the Baevsky stress index (SI) have been automatically computed.

Results

The post-test conversations with the tested subjects have demonstrated that the adult men most often consider the disputes with their wives to be the strongest memory impressions, and the women's disputes with their daughters are recognized by the female test subjects as most impressive. Attempts made by a human individual to find an emotional balance after such memorized events by imagining a peaceful conversation result greatest in a decrease in the SI values up to the SI level typical for the memories stored after encountering aggressive animals.

Consclusion

In the course of solving the above formulated research problem, we have succeeded in building a taxonomy of diverse domestic situations that can be used to refine and adjust the best ways of improving the stress resistance of a human individual. The presented taxonomy allows us to significantly narrow the range of possible targets for the targeted therapeutic treatment and select effective images used for the correction of a psycho-emotional state in a human.

Keywords

Cardiometric taxonomy, Cardiocode, Eyetracker, Stress resistance, Eustress, Distress, Domestic situations

Introduction

Stress as a defensive reaction, expressed as an increased tension of the human body in response to various adverse factors, has been one of the most actively studied phenomena during a whole century. For more than half a century, various cardiometric indicators of heart rate variability (HRV) have been used in scientific research of stress [1-4, 6-10]. The Baevsky stress index developed by R.M. Baevsky, employed to assess the HRV fluctuations in the regulatory systems in a human organism, is often referred to as a stress index, the values of which can be referred to a gradation to represent a sort of taxonomies, namely, the human subject's conditions and states ranging from eustress (corresponding to the optimal mobilization) to a destructive distress.

In one form or another, some researchers sporadically try to use the variability indices to assess the stress-inducing potential in diverse situations. Thus,

for example, based on the analysis of heart rate variability, A.P. Kulaichev has derived implications that the HRV values are markers of the prevalence of explicit or implicit stress in students within their examination session time and their intersessional period [3]. One more exemplary case is when researchers, in fact, provide an indirect assessment of a stress-triggering potential in various types of activity in athletes and complex machinery operators, when the investigators identify a relationship between the Baevsky stress index values and certain types of operational activities, or classify the associated groups of situations as normal-, subextreme- and extreme-type situations [2]. But, in our opinion, the capabilities of the heart rate variability analysis for assessing the stress-inducing potential of the different situations are far beyond the conventionally used cases in science and practice. In this connection, the task has been formulated to empirically verify the conceptual possibility of constructing a taxonomy of diverse domestic situations, which may become the basis for choosing the best ways to increase an individual stress resistance in a human subject.

Materials and methods

To solve the above research problem, upon completion of a polling survey of 154 respondents, a group of the most frequently encountered stress-inducing situations in the everyday life of a modern human subject has been identified. After ranking of the subjective evaluations of the occurrence rate of this sort of situations and the degree of intensity of stress induced by the situational cases, we have prepared a set of their laconic descriptions. This set has included the following situational cases: domestic disputes with various employees and relatives, conflict situations during daily trips on public or private transport and at workplace, unexpected encounters with dangerous animals and cases of inadequate behavior of some human individuals, sudden changes in plans combined with an increase in the degree of uncertainty or the need for additional costs, etc.

For each description of a stress-inducing situation, we have also produced another description to fix an alternative situational case, implying the state of being calm, peaceful, and untroubled, the state of well-balanced emotions and a greater sense of physical comfort. As a result, a catalogue of 10 paired tasks has been prepared by us. One of these tasks offers that an examinee should imagine and hold in his/her memory for a certain time an image of a stress-inducing situation case as designated by the examiner. The other examinee in this pair has been instructed to imagine an alternative situation, when anticipated are a high level of the calm, trouble-free state, physical comfort and good emotional balance.

During the execution of each task, an ECG and a rheogram of every examinee have been recorded. For this purpose, the Cardiocode PC-assisted devices have been used, and the respective mathematical models of the performance of the human cardiovascular system have been applied, including those cases described in detail in [5, 7, 9-11]. Upon processing of the obtained cardiometric records, values of the Baevsky stress index (SI) have been automatically computed. The group of the tested subjects covers 206 persons recruited from students and academics from Moscow universities, pilots from staff of some Russian airline companies, as well as participants of various groups practicing yoga and psycho-somatic self-regulation techniques. Statistical data processing has been performed using STADIA 8.0 mathematical software.

Results and discussion

Table 1 shows the respective statistical parameters of the obtained values of the Baevsky stress index (SI) in its descending order for diverse stress-inducing situations (in each pair this sort of situations comes first: 1.1, 2.1, 3.1, etc.). The SI values indicated in the Table have been obtained, as mentioned above, with the use of the Cardiocode PC-assisted hemodynamic analyzer, under the conditions, when the examinees have been performing the test tasks to imagine the following situational cases:

1.1 – a domestic dispute;

1.2 – a peaceful conversation;

2.1 – a conflict situation at workplace;

2.2 – a discussion of the routine job tasks;

3.1 – a conflict situation related to a public transport trip;

3.2 – a usual trip on public transport;

4.1 – receiving an expected instruction to urgently solve an irritating task that may deprive the examinee of something important and interesting;

4.2 – a peaceful evening at home;

5.1 – receiving an unanticipated message about considerable unforeseen expenses;

5.2 – a feeling of self-confidence in the test subject's sustainability and social recognition, belief to be capable of coping with various difficulties

Table 1. Main statistical parameters of SI values, obtained when the examinees performed the scheduled paired tasks as instructed by the examiner

Task No.	Mean arithmetic	Standard deviation	Median	Asymmetry	Excess
1.1	392	320	318	3	16
1.2	294	270	218	9	12
2.1	387	283	308	2	3
2.2	253	194	188	1	7
3.1	367	292	280	2	8
3.2	286	173	242	2	5
4.1	343	212	298	1	3
4.2	252	173	192	1	5
5.1	338	237	246	2	3
5.2	275	187	189	1	5
6.1	337	209	284	6	3
6.2	282	232	212	3	11
7.1	334	251	266	2	4
7.2	267	233	216	2	5
8.1	332	245	258	2	6
8.2	305	193	253	1	5
9.1	304	210	218	2	8
9.2	211	204	117	2	7
10.1	298	223	224	1	5
10.2	206	152	175	3	15

6.1 – an undesirable neighborhood to a very unpleasant person;

6.2 – a comfortable loneliness;

7.1 – a flashback to some troubles in the past;

7.2 – to imagine something causing a calm, well-balanced emotional state;

8.1 – to be accused by somebody of incompetence;

8.2 – obtaining evidence in favor of the examinee's competence;

9.1 – detecting of the examinee's wrong-doing act;

9.2 – to have a day off without any worries;

10.1 – to experience a sudden encounter with an aggressive pet;

10.2 – to have a quiet walk.

As may be seen from Table 1, the SI values can serve as a fingerprint for assessing the stress-triggering potential of various situations associated with the usual way of life of the average working adult. Among the above listed stressors, which are often found in our everyday life, these are precisely the domestic disputes which leave the strongest emotional memories, considering their psycho-physiological consequences.

The post-test conversations with the tested subjects have demonstrated that the adult men most often consider the disputes with their wives to be the strongest memory impressions, and the women's disputes with their daughters are recognized by the female test subjects as most impressive. Attempts made by a human individual to find an emotional balance after such memorized events by imagining a peaceful conversation result greatest in a decrease in the SI values up to the SI level typical for the memories stored after encountering aggressive animals.

It is particularly remarkable that the SI values can also assess the regulatory potential of various types of soothing memories. In this regard, simple memories of a quiet, enjoyable walks have been found to be the most successful in producing the desired result.

Conclusions

In the course of solving the above formulated research problem, we have succeeded in building a taxonomy of diverse domestic situations that can be used to refine and adjust the best ways of improving the

stress resistance of a human individual. The presented taxonomy allows us to significantly narrow the range of possible targets for the targeted therapeutic treatment and select effective images used for the correction of a psycho-emotional state in a human.

Statement on ethical issues
Research involving people and/or animals is in full compliance with current national and international ethical standards.

Conflict of interest
None declared.

Author contributions
V.A.Z., E.V.L., L.P.N. and M.Y.R. conceived and planned the experiments, interpreted the results. D.D.D., D.S.Y., P.A.M. and N.V.M. carried out the experiments and contributed to the interpretation of the results. A.S.O. took the lead in writing the manuscript and drafted the final version. All the authors read the ICMJE criteria for authorship and approved the final manuscript.

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