Estimation of Influence of Space and Terrestrial Weather on Psychophysiological Characteristics of Healthy and Sick People: Basic Problems and Solutions

(Project: Medico-biological Problems Related to Solar Activity)

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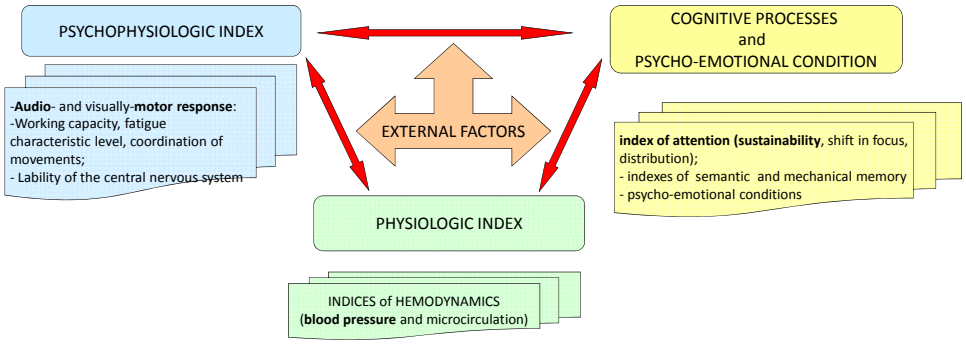
Summary

Stability of functioning of modern transport systems (aviation, automobile, railway, etc.) is in many respects defined by reliability of work of attendants (drivers, dispatchers, etc.). Reliability of work of any operator depends on many factors, including psycho physiological characteristics (PCHPC). There are many unsolved problems in this line of research and especially in problem of influence of space and terrestrial weather on these characteristics. The review on researches in the given direction is presented and basic ways of solving of the specified problems are given.

Current state of problem

As a trial studies the next parameters were measured: arterial blood pressure (ABP), the rate of simple audio-motor reaction (SAMR); index of productivity of arbitrary attention (PAA-index).

SAMR was estimated as an average response time delay from the computer sound stimulus and is measured in milliseconds. For estimations of PAA-index a standard psychophysical «proof test» was used, adapted for a presentation from the monitor screen.



In most cases the sensitivity of ABP, SAMR and PAA –index to the external factors was found. Both positive and negative correlation cases of psychophysiological indices to investigated external factors were observed. It turned out that these bidirectional reactions of psychophysiological indices can be explained by the nature of the personal health status depending on external factors. In some cases the degree of statistical connection psychophysiological indices with the correspondent values of ABP was much higher than with geomagnetic and meteorological parameters. It was found that for those volunteers, whose psychophysiological indices directly correlated with the ABP values, the signs of correlation of psychophysiological indices and ABP with the external factors coincided. For the volunteers, whose physiological indices have worsened with increase of arterial blood pressure, signs of correlation of the ABP and psychophysiological indices with the external factors were opposite (see Figures 2 and 3).

Thus the review of scientific researches in the given direction has shown that the basic ways of the decision of the specified problems are:

- An estimation of meteo- and magneto-sensitivity of PCHP taking into account the medical status of human organism (including diseases);
- Research of possibility of an estimation of variability of PCHP on dynamics of various indicators of vegetative nervous system (feature of individual communication of psycho physiological and physiological indicators).
- Research of possible mechanisms of PCHP reaction on external factors, an estimation of necessity of the account or corrections of the given dependence at individual level.

Some results

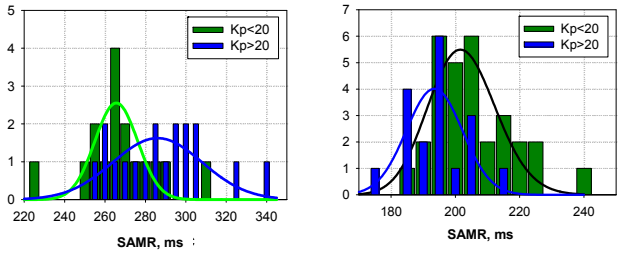


Fig. 2.
Examples of multidirectional reaction of SAMR to the influence of geomagnetic activity in healthy volunteer.
(А) –a woman, 20 years old, from Simpheropol (Russia)
(Б) – a woman, 39 years old, from Arkchangelsk (Russia)

Distribution of SAMR for samples selected for days with Kp (sum) >20 and for Kp (sum) <20 in case (A) shows that reaction time duration increases for higher values of Kp, however it decreases for case (B).

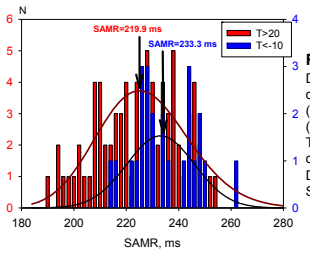


Fig. 3.
Distribution of SAMR selected for days with high temperatures (T>20ºC) and for low temperatures (T<-10ºC).
The volunteer was woman, 53 years old, Moscow.
Difference in average values of SAMR is 13 ms

Project Duration: *2011 - 2015*

In 2011 already collected data base in Moscow and in Sofia consists of more than 1000 daily measurements, each of them includes measurements of ABD, SAMR and PPA –indices.

The project reflects the intense interest towards the influence of solar activity and meteorology on human behavior. A number of publications reveal that such link may exist although we still do not know the exact mechanisms of these relationships.

Scope:

The project aims to study for putative relationships between space weather parameters and meteorology factors on the one hand, and human psycho-physiological parameters (PCHP) on the other. Until now, many questions remain unclear:

- What are the physiological mechanisms of the sensitivity of the human organism to external factors, including space weather and meteorology;
- What are the thresholds and characteristics of the fields (frequency, amplitude, speed changes, etc.), causing this sensitivity;
- The extent to which the above mentioned factors and indexes really influence human cerebral activity and behavior ;
- What are the dynamics of processes to adapt to changes in the parameters field;
- What are the prepositions for the high level of sensitivity to space weather and meteorology factors;
- What is the health and psychology effects of media aggressively "predicting" approaching magnetic storms, etc.
are only part of the tasks of the project.

In addition to fundamental values, the solution of these issues is of great practical importance for scientific substantiation of health regulations relating to the protection of the population, the safety of patients with abnormalities of the vascular and nervous systems, the preservation of efficiency of healthy people (especially those involved in the operator's activity - transport drivers, pilots, dispatchers).

Partners:

- **Space research Institute, Russian Academy of Sciences, Moscow, Russia**
- **Space and Solar-Terrestrial Research Institute, Bulgarian Academy of Sciences, Sofia, Bulgaria**
- **Institute for Population and Human Studies, Bulgarian Academy of Sciences, Bulgaria**
- **First Municipality Hospital, Sofia, Bulgaria**
- **University Hospital for Active Treatment "St. Anna", Sofia, Bulgaria**