Digital Databases In Information Systems For Hypoxia Studies: Model Substances Yackton, Sufan, Splenozide

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Information about the relative databases (DBs) construction for ones who work in spheres of hypoxic states studies, treatment and rehabilitation was presented. The version of constructed information system (IS) with DBs was demonstrared [1-3]. Some pequliarities of DBs construction for it were explained, and as "model" substances for such database the compounds yackton, sufan, and splenozide were selected, some works were done with C60 fullerene as well [4-6]. The idea of hypoxic states pharmacological regulation and correction is well known, it can be realized using pharmacological correction of hypoxic disorders by different preparations, for example, using novel substances [4-6]. Sure, such developments were supported by some mathematic methods application [7-8]. Because with time numerous bits of such information were recorded in memory of our laboratory computers – the necessity appeared to order such information using contemporary information technologies (IT) – databases (DBs), specialized IS with making of these data more accessible, more suitable for future processing and analysis. But in our case the DBs with such ordered information about substances had their peculiarities, and we paid attention to them. The main ones: such information was often not complete, it contained numerous details, its standartization was really difficult, some data could be changed with time and so on. Our experience how to overcome some of such difficulties was described.

Necessity of construction of computerized work places for medical personnel and researchers who work in hypoxic states studying and their pharmacological corrections. The ideas of constructing of computerized work places (automated, electronic work place – AWP, EWP) were attractive for many professionals in different fields, including medicine and biology). In our époque of information technologies (IT) development the idea of their application for the organization of the work of researchers and medical personnel is really in time [1-3]. Being linked using network technologies, such AWP (EWP) gives possibility for professionals to carry their research at contemporary level with high quality. In present report we will demonstrate our experience of such AWP (EWP) constructions for the people who work in spheres of hypoxia studies: laboratory researchers, doctors who work for the treatment or rehabilitation of patients with organism disorders caused by hypoxic states. Our information system (IS) with personal databases (DBs) for doctors and researchers of hypoxic states were constructed basing on our good knowledge of this type of laboratory work. An idea of "personal IS" with "personal DBs" was really important. Necessity of personal DBs appeared during intensive works with obtaining of great volume of experimental results, other laboratory information which the researcher obtained from day to day. Besides of this, the researchers usually need quick access to all data necessary for their works. And our experience of such multifunctional IS with DBs construction we had described in details. Some versions of information systems with databases were constructed; and they can be used by professionals, who work in sphere of hypoxic states examinations and their manifestations correction [2].

It is well known that hypoxic states can be developed due to different reasons – high altitudes (aviation, high mountain and extreme conditions); as the result of organism intoxications or diseases, different other reasons; such items were studied deeply by Ukrainian and foreign investigators during decades because of their importance for the practice. Different methods of hypoxic states regulation and organism recovery after them were studied and suggested. Among them there were ideas of hypoxic states regulation, hypoxic disorders and linked effects corrections using different pharmacological preparations. Dr. Gonchar O.O. during long years tried to do this in laboratory conditions by testing and use of novel preparations. Sure, such our findings and developments were based on the deep studying of the nature, different manifestations of hypoxic phenomena, using mathematical modelling [7, 8].

Substances for potential correction of hypoxic disorders - yackton, sufan, splenozide, C60 fullerene. These substances we studied can be used as potential preparations for hypoxia disorders treatment – C60 fullerene as well as such antioxidants yackton, sufan (derivatives of succinic acid) and splenozide (non-protein factor of a spleen) [4-6]. In these and other our articles and abstracts we had published yet the information about such substances, their chemical composition, properties, details of these properties experimental examination and obtained results of experiments. Sure, with time a lot of such information was recorded in our laboratory computers. There was a time of ordering of such information using contemporary information technologies – databases, convenient information system which did these data more accessible and easy for future processing and use.

Automated work place (AWP, EWP) – is an information system with few types of personal databases for the researchers who study hypoxic states. Above we had described how the idea of information system with personal databases for the investigators of hypoxic states had appeared. Sure, it is possible to find analogues and prototypes of the systems with databases like this. Our AWP demonstrates characteristics, the most close to necessities of researchers. For example, the necessity of personal databases appears when the researcher works intensively and enough great volume of his experimental results he obtained from day to day. Besides of this, the researchers need the quick access to all necessary data. Block-scheme of constructed AWP is shown on Fig.1.

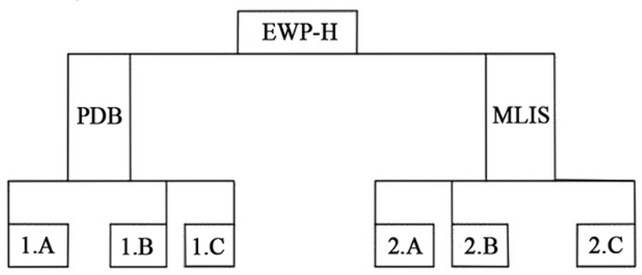

Fig. 1. **The block diagram of electronic workplace for the scientist, who study the effect of hypoxia in extreme conditions (EWP-H):**
PDB - private databases of this scientist; l.A - electronic versions of publications;
l.B - databases with information about substances and reagents;
l.C - DB with own experimental and working data;
MLIS - "mini-library Internet - system for physiologists"; 2.A, 2.B, 2.C - its constituent parts [2]

In our case of investigations of different pharmacological preparations influence the researcher need for his everyday work following electronic possibilities.

1 - Databases of pharmacological agents with the data of their physical and chemical properties.

2 - Database of the substances, necessary for the laboratory work with relative information (company of this chemical production, state of production, length of period of storage, storage conditions and so on).

3 - Database of the results of experiments. The data not only in numerical and symbolic form have to be written there – acting substances, their concentrations, values of effects and etc. The graphs, videos, photos have to be written here. All obtained data have to be recorded in forms, in which they would be able for retrieval with further processing and analysis. The example of the graphs drawn basing on obtained experimental data is given on Fig.2. The tables with experimental results are suggested below too.

4 - Database of everyday protocols of experiments. It is known that each experiment has to be supplemented by protocol with the details of this experiment that cannot be lost.

5 - Database with the results of experimental data analysis.

"Personal mini library" as example of personal databases for researcher of hypoxic states. Separately it is necessary to form a set of databases that could be called "Personal mini library". Such databases can be of two types.

1 - "Mini library" of the sources of scientific literature, which researcher need for everyday work in electronic form: books, articles, patents, catalogues and etc. The example of the data of such database ones can see in "References" for this conference article.

2 - Database of own publication of the researcher in electronic form – also books, articles, patents, abstracts of conferences, and so on. In this case too, it is possible to use own publications from electronics profiles of researcher in "ResearchGate" or "Google Scholar (Academia)". But many of scientists know how unstable sometimes is the information in such profiles. So, to insure ourselves, it is better to double this information in personal databases of own local computer.

Table 1 State of glutathione system and activity of glucose-6-phosphate dehydrogenase in rat heart after acute and chronic exercise, and after yackton administration

Groups	GSH *μmol/mg protein*	GR *nmol NADPH/ min/ mg protein*	GPx *μmol/ GSH/ mg protein*	G6PDH *nmol NADPH/ min/ mg protein*
Control	1.70 ± 0.10	8.22 ± 0.64	7.42 ± 0.86	2.79 ± 0.18
Acute exercise (30 min)	1.0 ± 0.07 **	7.06 ± 0.88	5.27 ± 0.59 *	3.14 ± 0.16
Chronic exercise (4 wk)	2.02 ± 0.14 *	10.45 ± 1.06 *	8.24 ± 1.01	3.51 ± 0.21 *
Yackton administration	2.50 ± 0.20 **	9.13 ± 0.82	11.29 ± 1.12 **	3.04 ± 0.26
Acute exercise + yackton administration	2.44 ± 0.16 **·#	9.79 ± 1.10	10.84 ± 0.96 *·#	3.18 ± 0.41
Chronic exercise (4 wk) + yackton administration	2.18 ± 0.12 **	10.0 ± 1.12	10.79 ± 0.89 *·#	3.27 ± 0.18 *

Values are means ± SEM. n = 10 in each group. GSH, reduced glutathione; GR, glutathione reductase; GPx, glutathione peroxidase; G6PDH, glucose-6-phosphate dehydrogenase. Significance is expressed as follows: * - p < 0.05 vs control; ** - p < 0.01 vs control; # - p < 0.05 vs chronic exercise (*t*- Student).

Table 2 State of glutathione system and activity of glucose-6-phosphate dehydrogenase in rat tissues at nitrite intoxication and after splenozide treatment

Groups		Liver	Heart	Brain
		Glutathione	(μM / mg protein)	
Control				
Nitrite intoxication		3.90 ± 0.02	2.10 ± 0.01	1.93 ± 0.06
Splenozide+		1.60 ± 0.02 *	1.06 ± 0.02 *	0.62 ± 0.01 *
nitrite intoxication		2.30 ± 0.01* **	1.59 ± 0.01* **	1.04 ± 0.03* **
One-way	F	1131,28	365,98	1692,07
ANOVA	df	3,20	3,20	3,20
	P	< 0,001	<0,001	<0,001
		Glutathione (nM NADPH/	reductase min/mg protein)	
Control				
Nitrite intoxication		23.18 ± 0.24	10.32 ± 0.15	11.40 ± 0.12
Splenozide+		16.00 ± 0.10 *	7.60 ± 0.12 *	8.71 ± 0.15 *
nitrite intoxication		18.98 ± 0.10* **	9.24 ± 0.11* **	9.77 ± 0.17 * **
One-way	F	379,07	21,00	320,29
ANOVA	df	4,25	4,25	4,25
	P	< 0,001	<0,001	<0,001
		Glutathione (μMGSH/	peroxidase mg protein)	
Control				
Nitrite intoxication		5.53 ± 0.06	6.42 ± 0.02	4.87 ± 0.03
Splenozide+		3.01 ± 0.06 *	4.50 ± 0.06 *	1.41 ± 0.01 *
nitrite intoxication		4.39 ± 0.05 * **	6.00 ± 0.02 **	2.12 ± 0.06 * **
One-way	F	163,84	73,84	218,17
ANOVA	df	4,25	4,25	4,25
	P	< 0,001	<0,001	<0,001
		Glucose-6- (nM NADPH/	phosphate min/ mg protein)	dehydrogenase
Control				
Nitrite intoxication		16.10 ± 1.8	8.43 ± 1.0	10.56 ± 1.2
Splenozide+		16.99 ± 1.1 *	9.16 ± 1.2	11.03 ± 0.9
nitrite intoxication		26.16 ± 0.9 * **	18.64 ± 1.1 * **	14.02 ± 1.4 * **
One-way	F	2189,28	732,35	93,98
ANOVA	df	3,16	3,16	3,16
	P	< 0,001	<0,001	<0,001

Values are means ± SEM of 10 rats. Significance is expressed as follows: * - P < 0.001 compared with control; ** - P < 0.001 between experimental groups (Bonferroni's test)

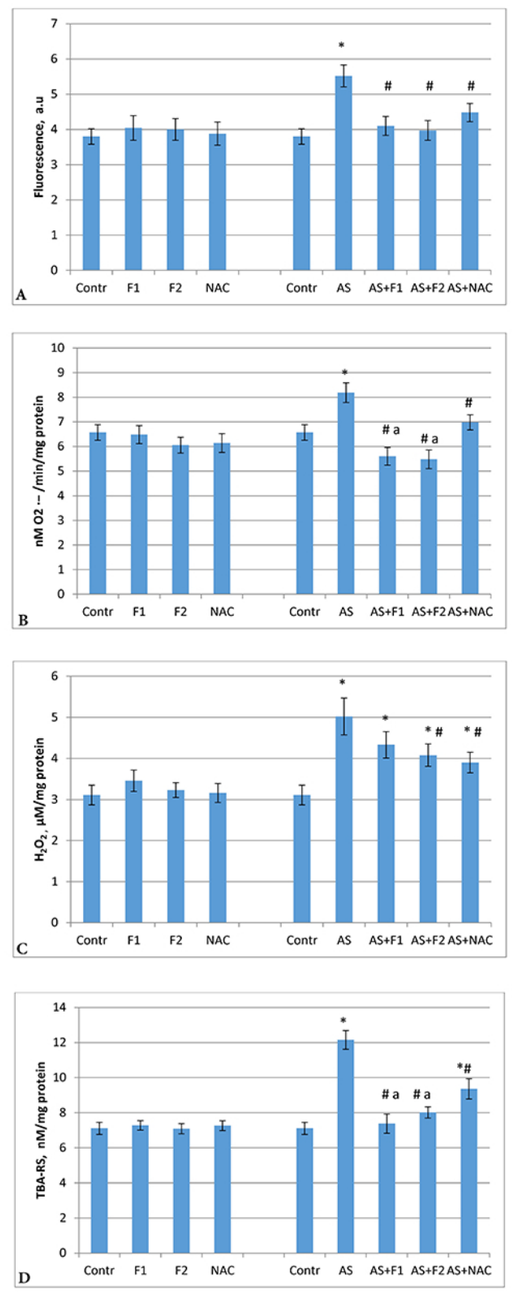

Fig. 2 Effect of C60FAS [50μg/kg (F1), C60FAS 500μg/kg (F2)], and NAC on oxidative stress markers: ROS formation (A), O2•– (B), H2O2 (C), and TBARS (D) production in brain tissue after alone administration and after acute restraint stress exposure (AS). Values are means ±SD (n=8). The data were analyzed for statistical significance using ANOVA followed by Bonferroni post hoc test. *P<0.05 vs control group; #P<0.05 vs acute stress group; aP<0.05 vs AS+NAC group.

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Conduslons. In present publication the construction of information system AWP with personal DBs and "Personal mini library" was observed as well as other practical IT applications developed for doctors and researchers who work in spheres of hypoxic states studies, including different aspects of hypoxic states development. These our works were important too for ones who worked with hypoxic states corrections by different pharmacological preparations; in our case there were yackton, sufan, splenozide, C60 fullerene studied by the authors. Examples of the databases constructed for such IS were given on the base of obtained experimental results for the substances yackton, sufan, splenozide, C60 fullerene and others; some tables and graphs with such results were demonstrated as well. So, these results can be used too by all, who work in spheres of the hypoxic states examinations and their manifestations corrections. The construction of information system for such researchers with personal databases and "Personal mini library" was described.