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SIMILARITY OF ADAPTOGENIC EFFECTS OF BIOACTIVE NAFTUSSYA WATER AND PHYTOCOMPOSITION "BALM TRUSKAVETS'"

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Summary
Background. From previous studies, it is known about the adaptogenic properties of Naftussya bioactive water and the Ukrainian phytocomposition "Balm Truskavets'". Both adaptogens have a common component of the composition - polyphenols, which suggests the existence of similar effects on the parameters of the body responsible for adaptation. The purpose of this study is to test the hypothesis. **Material and methods**. The object of clinical-physiological observation were 30 practically healthy individuals of both sexes with dysfunction of the neuro-endocrine-immune complex as a manifestation of maladaptation. Before and after a one-week course of using Balm (10 people) or Naftussya water (20 people), plasma levels of the main adaptation hormones, parameters of electroencephalogram (EEG), heart rate variability (HRV), phagocytosis, leukocytogram, as well as acupuncture and bioelectrophotonics were recorded. **Results**. 39 parameters (18 EEGs, 8 HRVs, 5 biophysical, 4 phagocytosis, as well as the Popovych's leukocytary adaptation index, triiodothyronine, testosterone and cortisol) were identified, the physiologically favorable changes of which are common to both adaptogenic means. **Conclusion.** The influence of adaptogens of various nature on the state of adaptation of the body is non-specific and is implemented through the neuro-endocrine-immune complex.
Key words: Naftussya bioactive water, phytocomposition "Balm Truskavets", neuro-endocrine-immune complex.

INTRODUCTION

Previous experimental and clinical-physiological studies have shown that the Ukrainian phytocompositions "Balm Kryms'kyi" and its analogue "Balm Truskavets'" corresponds to some attributes of adaptogens: the ability to cause a state of non-specifically increased resistance of the body to the influence of adverse environmental factors of a physical, chemical and **biological** nature [19,24,30,42]. An even stronger proof of the adaptogenic ability of the phytocomposition is an increase in the leukocytary Popovych's **adaptation** index [15] (sorry for the immodesty, but it is necessary not to be confused with the leukocytary Garkavi's adaptation index [20]), which reflects the **quantitative** assessment of qualitative changes in the body's general adaptive reactions, namely, a decrease in the share of pathological and premorbid (disharmonious) reactions and an increase in the share of normal (harmonious) reactions [19,21,30,47]. The adaptogenic effect of phytocompositions is accompanied by favorable changes in the parameters of neuro-endocrine regulation, as well as acupuncture points and bioelectrophotonics [15-18,51].

The most investigated medicinal herbs for their adaptogenic activity are Panax ginseng, Eleutherococcus senticosus, Withania somnifera, Schisandra chinensis, Rhaponticum carthamoides, Lepidium meyenii, and Rhodiola spp. Phytochemicals that have been demonstrated adaptogenic properties mainly belong to **polyphenolic** compounds [14,36,42,52].

Currently, we do not have data on the chemical composition of the "Balm Truskavets'". In the composition of its analogue "Balm Kryms'kyi" [1,19,30,38,43], polyphenols were detected in the amount of 4 mg/L compared to 7 mg/L in ginseng tincture (produced by "Lubnykhimfarm") [1]. It is interesting that polyphenols in amounts of 0,039÷0,28 mg/L were also found in the composition of bioactive Naftussya water [25,47], the adaptogenic properties of which have long been known [19,21,22,24,30,46,47,50]. This suggests the existence of **joint** effects of both adaptogens, the purpose of this study is to verify this.

MATERIAL AND RESEARCH METHODS

The object of observation serwed employees of the clinical sanatorium "Moldova" and PrJSC “Truskavets’ Spa”: 16 women 25-76 years and 14 men 31-69 years. The volunteers were considered practically healthy (without a clinical diagnosis), but the initial testing revealed deviations from the norm in a number of parameters of the neuro-endocrine-immune complex (details follow) as a manifestation of maladaptation.

In the morning in basal condition registered kirlianogram by the method of GDV by the device of “GDV Chamber” (“Biotechprogress”, SPb, RF). Method of GDV, essence of which consists in registration of photoelectronic emission of skin, induced by high-frequency electromagnetic impulses, allows to estimate integrated psycho-somatic state of organism. Program estimates also Energy and Asymmetry of virtual Chakras [29]. Then recorded simultaneosly electrocardiogram (ECG) and electroencephalogram (EEG). ECG recorded during 7 min in II lead to assess the parameters of heart rate variability (HRV) (hardware-software complex "CardioLab+HRV" produced by "KhAI-Medica", Kharkiv). For further analysis the temporal and spectral parameters were selected [9,11,23,53]. EEG recorded a hardware-software complex “NeuroCom Standard” (KhAI Medica, Kharkiv) monopolar in 16 loci (Fp1, Fp2, F3, F4, F7, F8, C3, C4, T3, T4, P3, P4, T5, T6, O1, O2) by 10-20 international system, with the reference electrodes A and Ref on the earlobes. Two minutes after the eyes had been closed, 25 sec of artifact free EEG data were collected by computer. In addition to the received parameters, we calculated coefficient of Asymmetry (As) and Laterality Index (LI) for power spectral density (PSD) each rhythm using equations:

As, % = 100•(Max – Min)/Min; LI, % = Σ [200•(Right – Left)/(Right + Left)]/8.

We calculated for HRV and each locus EEG the Entropy (h) of normalized PSD using Popovych’s IL [21,47,51] equations based on classic Shannon’s CE [54] equation:

$hHRV = -[PSHF \cdot \log_2 PSHF + PSLF \cdot \log_2 PSLF + PSVLF \cdot \log_2 PSVLF + PSULF \cdot \log_2 PSULF]/\log_2 4$;

$hEEG = -[PSD\alpha \cdot \log_2 PSD\alpha + PSD\beta \cdot \log_2 PSD\beta + PSD\theta \cdot \log_2 PSD\theta + PSD\delta \cdot \log_2 PSD\delta]/\log_2 4$.

Electroconductivity (EC) recorded in follow points of acupuncture: Pg(ND), TR(X) and MC(AVL) at Right and Left side. Used complex “Medissa”. For each pair, the Laterality Index was calculated according to the already mentioned equation. In portion of capillary blood counted up Leukocytogram (LCG) (Eosinophils, Stub and Segmentonucleary Neutrophils, Lymphocytes and Monocytes) and calculated its Adaptation Index as well as Strain Index by Popovych IL [21].

Table 1. Quantification of General Adaptation Reaction of Organism, first version [22]

Leukocyto-gram Lymphocy-tes level, %	**G**eneral **A**daptation **R**eaction of **O**rganism	Eosinophils and Stub Neutrophils: 1÷6 %; Monocytes: 4÷7 %; Leukocytes: 4÷8 G/l	Eosinophils and Stub Neutrophils: <1; >6; Monocytes: <4; >7; Leukocytes: <4; >8 G/l
<21	Stress	**1,22**	**0,02**
21÷27	Training	**1,46**	**0,74**
28÷33	Quiet Activation	**1,95**	**0,98**
34÷43,5	Heightened Activation	**1,70**	**0,50**
≥44	Overactivation		**0,26**

Strain Index-1 = $[(Eo/3,5-1)^2 + (SN/3,5-1)^2 + (Mon/5,5-1)^2 + (Leu/6-1)^2]/4$.

Parameters of phagocytic function of neutrophils estimated as described by Kovbasnyuk MM [33,49]. The objects of phagocytosis served daily cultures of Staphylococcus aureus (ATCC N 25423 F49) as typical specimen for Gram-positive Bacteria and Escherichia coli (O55 K59) as typical representative of Gram-negative Bacteria. Take into account the following parameters of Phagocytosis: activity (percentage of neutrophils, in which found microbes - Hamburger’s Phagocytic Index PhI), intensity (number of microbes absorbed one phagocytes - Microbial Count MC or Right’s Index) and completeness (percentage of dead microbes - Killing Index KI). On the basis of the registered partial parameters of phagocytosis, taking into account the content of neutrophils (N) in 1 L of blood, the integral parameter - the bactericidal capacity of neutrophils - was calculated by the formula:

BCCN (10^9 Bact/L) = N (10^9/L)•PhI (%)•MC (Bact/Phag)•KI (%)•10^{-4}.

At last in portion of venous blood determined plasma levels of major hormones of adaptation: Cortisol, Testosterone, Aldosterone, Triiodothyronine and Calcitonin (by the ELISA with the use of analyzer "RT-2100C" (ChPR) and corresponding sets of reagents from "Алкор Био", XEMA Co, Ltd and DRG International Inc).

After the initial testing, during the week 20 volunteers (10 women 33÷76 y and 10 men 37÷69 y) used Naftussya water (250 ml 1 hour before meals three times a day), and the other 10 (6 women 25÷63 y and 4 men 31÷60 y) "Balm Truskavets'" (5 mL pre-diluted in 250 ml of boiled tap water according to a similar scheme). The next morning after completing the treatment, retesting was performed.

Reference values are taken from the database of our laboratory (EEG, GDV, Immunity) or instructions (HRV & ELISA). Results processed using the software package "Statistica 6.4".

RESULTS AND DISCUSSION

According to the algorithm of Truskavetsian Scientific School, at the preparatory stage of data analysis the registered parameters (variables) were normalized, which allowed their correct comparison. Further, profiles of normalized parameters were created, the levels of which differ significantly before and after treatment (regardless of the nature of the adaptogens), as well as several parameters which according to the following discriminant analysis were still **recognizable**, despite the **insignificant** value of Student's t criterion (Fig. 1).

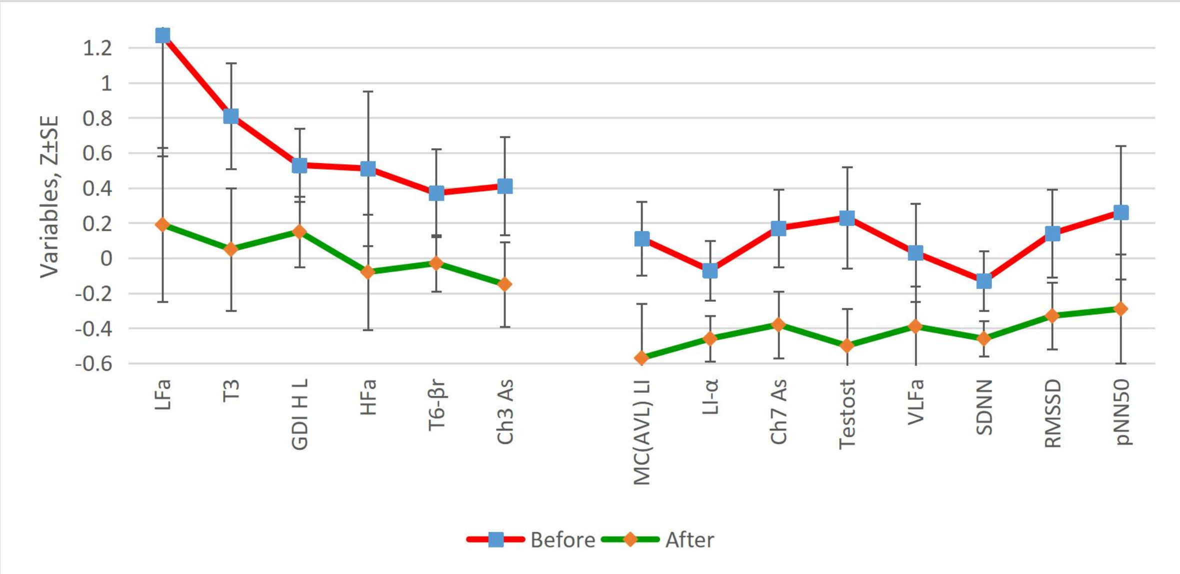

Fig. 1. Profiles of variables whose normalized levels (Z±SE) are decreasing under the influence of the treatment. Clusters B+/A0 and B0/A-

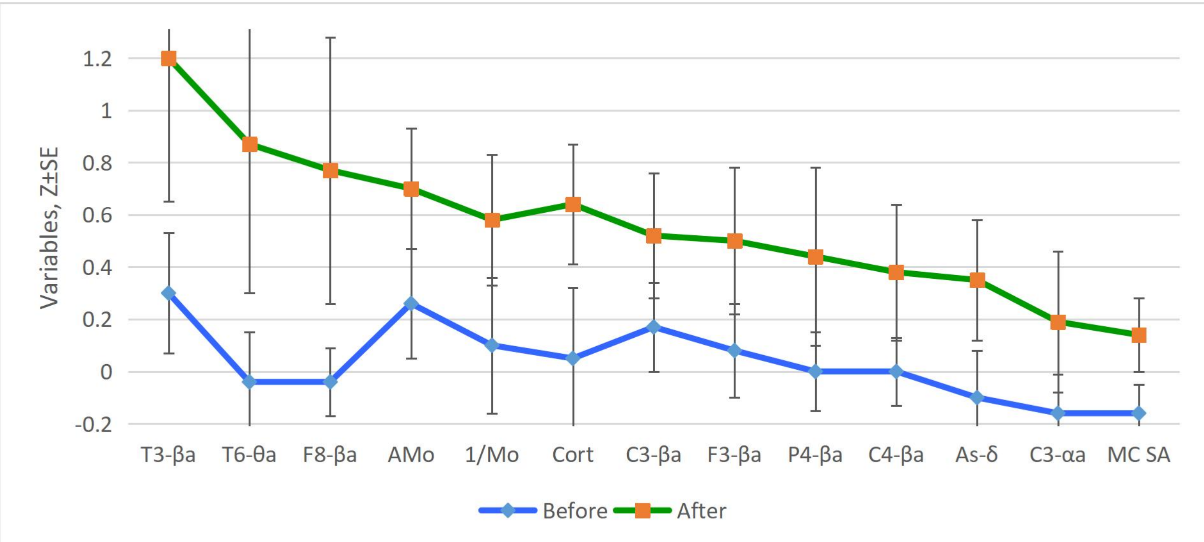

Fig. 2. Profiles of variables whose normalized levels (Z±SE) are increasing under the influence of the treatment. Cluster B0/A+

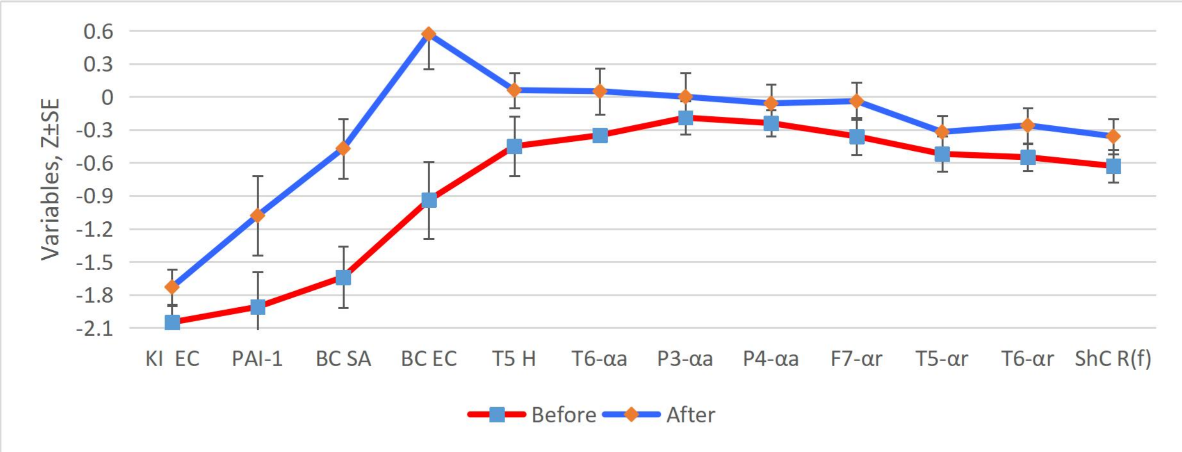

Fig. 3. Profiles of variables whose normalized levels (Z±SE) are increasing under the influence of the treatment. Cluster B-/A0

Another approach to quantifying effects is to calculate the direct differences between the final and initial parameters levels of each patient (Fig. 4).

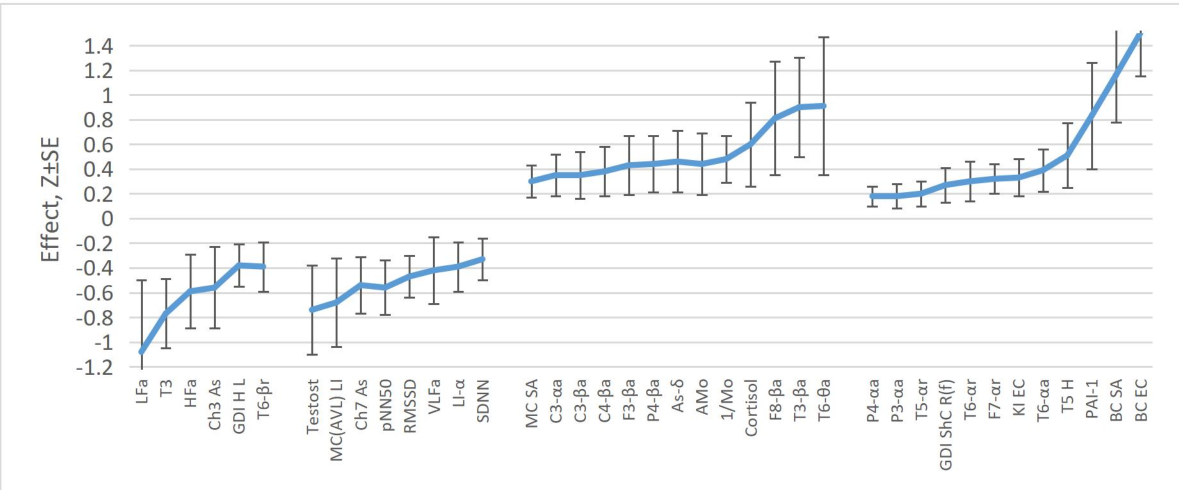

Fig. 4. The clusters of effects of the treatment as direct differences of normalized variables (Z±SE)

Next, 39 parameters were grouped into 4 clusters, of which 2 are enhancing and 2 are reducing (Fig. 5 and Table 2).

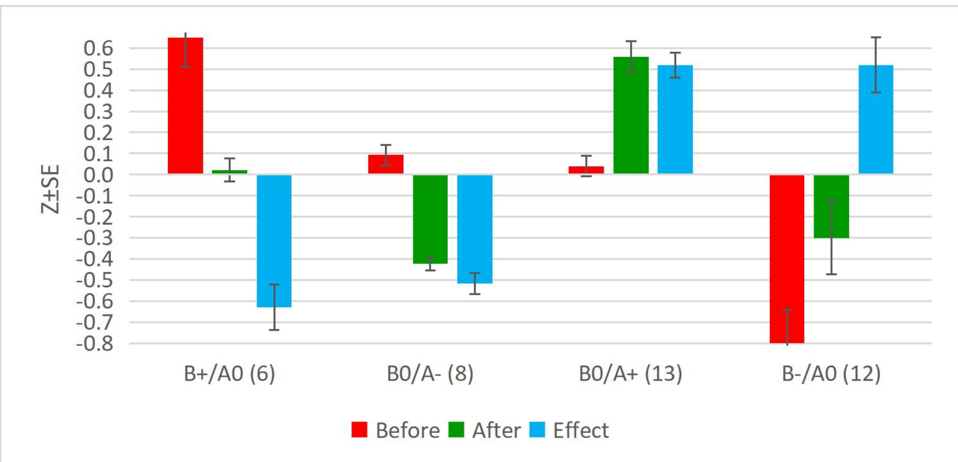

Fig. 5. Clusters of adaptogenic effects. ***The number of variables is indicated in parentheses***

Table 2. Clusters of adaptogenic effects as differences between levels (Z±SE) after and before treatment

Clusters and Variables	Root/Variabl correlation	Before (30)	After (30)	*Effect (30)*
B+/A0		**0,65±0,14**	**0,02±0,05**	**-0,63±0,11**
Triiodothyronine	**0,181**	0,81±0,30	0,05±0,35	-0,77±0,28
T6-β PSD r	**0,145**	0,37±0,25	-0,03±0,16	-0,39±0,20
PSD LF band		1,27±0,69	0,19±0,44	-1,08±0,58
PSD HF band		0,51±0,44	-0,08±0,33	-0,59±0,30
Chakra 3 Asymmetry		0,41±0,28	-0,15±0,24	-0,56±0,33
Entropy GDI Left		0,53±0,21	0,15±0,20	-0,38±0,17
B0/A-		**0,09±0,05**	**-0,42±0,03**	**-0,52±0,05**
Testosterone	**0,208**	0,23±0,29	-0,50±0,21	-0,74±0,36
SDNN HRV	**0,179**	-0,13±0,17	-0,46±0,10	-0,33±0,17
RMSSD HRV		0,14±0,25	-0,33±0,19	-0,47±0,17
pNN_{50} HRV		0,26±0,38	-0,29±0,31	-0,56±0,22
PSD VLF band		0,03±0,28	-0,39±0,23	-0,42±0,27
Laterality-α		-0,07±0,17	-0,46±0,13	-0,39±0,20
Chakra 7 Asymmetry	**0,204**	0,17±0,22	-0,38±0,19	-0,54±0,23
AP MC(AVL) Laterality		0,11±0,21	-0,57±0,31	-0,68±0,36
B0/A+		**0,04±0,05**	**0,56±0,07**	**+0,52±0,06**
Cortisol	**-0,182**	0,05±0,27	0,64±0,23	+0,60±0,34
Asymmetry-δ	**-0,162**	-0,10±0,18	0,35±0,23	+0,46±0,25
T3-β PSD a	**-0,166**	0,30±0,23	1,20±0,55	+0,90±0,40
F3-β PSD a	**-0,141**	0,08±0,18	0,50±0,28	+0,43±0,24
T6-θ PSD a	**-0,091**	-0,04±0,19	0,87±0,57	+0,91±0,56
F8-β PSD a		-0,04±0,13	0,77±0,51	+0,81±0,46
P4-β PSD a		0,00±0,15	0,44±0,34	+0,44±0,23
C4-β PSD a		0,00±0,13	0,38±0,26	+0,38±0,20
C3-β PSD a		0,17±0,17	0,52±0,24	+0,35±0,19
C3-α PSD a		-0,16±0,15	0,19±0,27	+0,35±0,17
Amplitude of Mode HRV		0,26±0,21	0,70±0,23	+0,44±0,25
1/Mode HRV		0,10±0,26	0,58±0,25	+0,48±0,19
Microbial count for Staph. aur.		-0,16±0,11	0,14±0,14	+0,30±0,13
B-/A0		**-0,82±0,18**	**-0,30±0,17**	**+0,52±0,13**
Bactericidity vs E. coli	**-0,349**	-0,94±0,35	0,57±0,32	+1,50±0,35
Bactericidity vs Staph. aureus	**-0,332**	-1,64±0,28	-0,47±0,27	+1,16±0,38
Killing Index vs E. coli	**-0,164**	-2,05±0,15	-1,73±0,16	+0,33±0,15
Popovych's Adaptation Index-1		-1,91±0,32	-1,08±0,36	+0,83±0,43
T5-α PSD r	**-0,097**	-0,52±0,16	-0,32±0,15	+0,20±0,10
T6-α PSD a		-0,35±0,06	0,05±0,21	+0,39±0,17
T6-α PSD r		-0,55±0,12	-0,26±0,16	+0,30±0,16
P4-α PSD a		-0,24±0,12	-0,06±0,17	+0,18±0,08
P3-α PSD a		-0,19±0,15	0,00±0,22	+0,18±0,10
F7-α PSD r		-0,36±0,17	-0,04±0,17	+0,32±0,12
T5 PSD Entropy		-0,45±0,27	0,06±0,16	+0,51±0,26
Shape Coefficient Right (f)		-0,63±0,15	-0,36±0,16	+0,27±0,14

In particular, the moderately **increased** levels of plasma triiodothyronine, PSD of β-rhythm in T6 locus as well as LF and HF bands of HRV, Entropy of Gas Discharge Image in Left projection (H GDI L) and right-sided (positive sign of symmetry index) asymmetry of the virtual third Chakra are completely **normalized** (cluster B+/A0).

Instead, the significantly **reduced** levels of the Popovych's adaptation index and the bactericidal capacity of neutrophils (BCCN) vs both E. coli and Staph. aureus **increase** significantly, still remaining low. At the same time, the moderately **reduced** levels of the PSD of α-rhythm in F7, P4, P3, T6 and T5 loci and Entropy in T5 locus as well as Shape Coefficient of GDI in Right projection (SC GDI R) are completely **normalized** (cluster B-/A0).

That is, there is a **normalizing** (ambivalence-equilibratory) effect as one of the attributes of adaptogens [1,10,30,42] according to the good old "law of initial level".

At the same time, **normal** levels of plasma testosterone, four HRV-markers of vagal tone **also decrease,** albeit slightly. This is accompanied by left lateralization (negative sign of symmetry/lateralization indices) of initially symmetrical (quasi-zero symmetry/lateralization indices) EEG α-rhythm, electrical conductivity of acupuncture points MC(AVL) and virtual seventh Chakra (cluster B0/A-).

On the other hand, **normal** levels of cortisol and circulating catecholamines (1/Mo as HRV-marker), sympathetic tone (AMo as HRV-marker) as well as activity of β-, θ- and α-rhythm generating neurons in 7 loci **also increase**, albeit slightly. This is accompanied by a rightward shift in the symmetry of δ-rhythm (cluster B0/A+).

The described changes in parameters of EEG, HRV, hormones and bioelectrophotonics are negatively/positively correlated with the changes in parameters of phagocytosis [21,31,33,47,49] (as well as of immunity [21,31,34,35,46-48]), so effects of the treatment are physiologically favorable and therefore adaptogenic.

The previously selected variables were further subjected to discriminant analysis with the aim not so much to discover which of them are formally characteristic, but to visualize the integral state of each volunteer. The forward stepwise program included only 14 variables in the discriminant model, including those subject to non-significant (t<2,02) effects according to the Student's criterion (Tables 3-4), while other variables were outside the model, despite significant (*) changes (Tables 5-6). On the face of it, the Wilks' and Student's statistics do not match completely.

Table 3. Discriminant Function Analysis Summary

Step 14, N of vars in model: 14; Grouping: 2 grps; Wilks' Λ: 0,4117; approx. $F_{(14)}$=4,6; $p<10^{-4}$

Variables currently in the model	**State (n) and Mean±SE**			**Parameters of Wilks' Statistics**					
	Before (30)	**After (30)**	***Effect (30)***	Wilks' Λ	Partial Λ	F-remove (1,45)	p-level	Tolerancy	Refer Cv **SD**
T6-β PSD, %	35,9 4,1	29,4 2,7	*-6,5* *3,2**	0,439	0,939	2,94	0,093	0,582	29,8 0,554
T3-β PSD, μV^2/Hz	94 13	145 31	*+50* *23**	0,473	0,870	6,73	0,013	0,151	77 0,726
F3-β PSD, μV^2/Hz	83 10	106 15	*+23* *13*	0,445	0,926	3,60	0,064	0,117	79 0,682
T5-α PSD, μV^2/Hz	25,7 2,9	29,2 2,7	*+3,5* *1,9*	0,504	0,816	10,1	0,003	0,393	35,1 0,516
T6-θ PSD, μV^2/Hz	22 4	41 11	*+18* *11*	0,428	0,962	1,77	0,190	0,732	23 0,869
Asymmetry-δ, %	39,3 4,3	50,3 5,5	*+11,0* *6,0*	0,452	0,911	4,39	0,042	0,792	41,8 0,580
SDNN HRV, msec	52,0 5,1	42,2 3,2	*-9,8* *4,9**	0,414	0,995	0,21	0,651	0,453	55,9 0,531
Testosterone standardized, Z	+0,23 0,29	-0,50 0,21	*-0,74* *0,36**	0,466	0,883	5,96	0,019	0,726	0 0,500
Cortisol, nM/L	375 31	442 26	*+67* *38*	0,436	0,945	2,63	0,112	0,641	370 0,303
Triiodothyronine, nM/L	2,61 0,15	2,22 0,18	*-0,38* *0,14**	0,431	0,955	2,12	0,152	0,756	2,20 0,227
Bactericidity vs E. coli, 10^9 B/L	89,5 3,5	104,4 3,1	*+14,9* *3,5**	0,421	0,979	0,98	0,329	0,351	99 0,100
Killing Index vs E. coli, %	42,2 1,5	45,3 1,5	*+3,2* *1,4**	0,446	0,923	3,78	0,058	0,293	62,0 0,156
Bactericidity vs St. aur., 10^9 B/L	88,4 2,9	100,7 2,8	*+12,3* *4,0**	0,431	0,956	2,07	0,157	0,491	106 0,100
Chakra 7 Asymmetry	0,08 0,05	-0,05 0,05	*-0,13* *0,05**	0,476	0,865	7,03	0,011	0,649	0,04 **0,24**

Notes. In each column, the first line is the average, the second – SE. In norm column - the average and Cv or ***SD***. The "*Effect*" and "*Norm*" columns are not the result of discriminant analysis

Table 4. Summary of stepwise analysis of discriminant variables ranked by criterion Λ

Variables currently in the model	F to enter	p-level	Λ	F-value	p-value
Bactericidity vs E. coli, 10^9 B/L	10,1	0,002	0,852	10,1	0,002
SDNN HRV, msec	5,95	0,018	0,771	8,46	0,001
Chakra 7 Asymmetry	4,85	0,032	0,710	7,64	10^{-3}
Testosterone standardized, Z	5,62	0,021	0,644	7,60	10^{-4}
T6-β PSD, %	3,60	0,063	0,604	7,09	10^{-4}
Cortisol, nM/L	2,20	0,144	0,580	6,41	10^{-4}
T3-β PSD, μV^2/Hz	1,94	0,169	0,559	5,87	10^{-4}
Asymmetry-δ, %	1,95	0,168	0,538	5,47	10^{-4}
T5-α PSD, μV^2/Hz	3,04	0,087	0,507	5,40	10^{-4}
F3-β PSD, μV^2/Hz	3,11	0,084	0,477	5,37	10^{-4}
Killing Index vs E. coli, %	1,86	0,179	0,459	5,14	10^{-4}
Triiodothyronine, nM/L	1,59	0,213	0,444	4,90	10^{-4}
Bactericidity vs St. aur., 10^9 B/L	1,74	0,193	0,428	4,73	10^{-4}
T6-θ PSD, μV^2/Hz	1,77	0,190	0,412	4,59	10^{-4}

Table 5. EEG variables currently not in the discriminant model

Variables currently not in the model	State (n) and Mean±SE			Parameters of Wilks' Statistics					
	Before (30)	**After (30)**	***Effect (30)***	Wilks' Λ	Partial Λ	F to enter	p-level	Tolerancy	Refer Cv **SD**
Laterality-α, %	-3 6	-17 4	*-13* *7*	0,408	0,990	0,45	0,504	0,639	-1 **34**
F7-α PSD, %	22,4 2,4	27,0 2,4	*+4,6* *1,7**	0,412	1,000	0,01	0,940	0,446	27,6 0,522
C3-α PSD, μV^2/Hz	135 25	193 44	*+58* *29**	0,412	1,000	0,01	0,936	0,294	162 1,039
T6-α PSD, %	25,6 2,1	30,9 2,8	*+5,3* *2,8*	0,411	0,999	0,03	0,873	0,256	35,5 0,502
T6-α PSD, μV^2/Hz	63 9	121 32	*+58* *25**	0,412	1,000	10^{-4}	0,994	0,506	114 1,302
P3-α PSD, μV^2/Hz	216 55	286 84	*+70* *39*	0,410	0,997	0,14	0,711	0,365	287 1,319
P4-α PSD, μV^2/Hz	195 46	265 66	*+70* *29**	0,412	1,000	0,02	0,894	0,365	288 1,318
P4-β PSD, μV^2/Hz	89 8	113 18	*+24* *13*	0,412	1,000	0,01	0,918	0,291	89 0,611
P3-β PSD, μV^2/Hz	104 10	120 16	*+16* *8**	0,411	0,999	0,05	0,827	0,276	93 0,665
C4-β PSD, μV^2/Hz	96 8	121 17	*+25* *13*	0,411	0,998	0,07	0,786	0,118	96 0,691
F8-β PSD, μV^2/Hz	43 5	71 17	*+28* *16*	0,409	0,993	0,30	0,583	0,446	44 0,771
C3-β PSD, μV^2/Hz	96 8	121 17	*+25* *13*	0,411	0,998	0,09	0,763	0,063	96 0,691
Entropy T5 PSD	0,767 0,035	0,833 0,021	*+0,066* *0,033**	0,411	0,999	0,05	0,832	0,652	0,825 0,156

Table 6. HRV, Immune and Biophysics variables currently not in the discriminant model

Variables currently not in the model	State (n) and Mean±SE			Parameters of Wilks' Statistics					
	Before (30)	**After (30)**	***Effect (30)***	Wilks' Λ	Partial Λ	F to enter	p-level	Tolerancy	Refer Cv **SD**
Mode HRV, msec	864 26	822 26	*-48* *19**	0,412	1,000	10^{-5}	0,999	0,627	874 0,115
Amplitude Mode HRV, %	43,6 2,9	48,4 2,9	*4,8* *2,8*	0,407	0,989	0,48	0,490	0,796	39,2 0,329
RMSSD HRV, msec	30,9 3,8	24,0 2,9	*-6,8* *2,4**	0,410	0,996	0,17	0,683	0,221	29,4 0,482
pNN_{50}, %	11,6 3,0	6,7 2,3	*-4,9* *2,0**	0,412	1,000	0,01	0,910	0,284	9,0 0,846
PSD HF band, $msec^2$	545 153	360 110	*-185* *97*	0,412	1,000	10^{-3}	0,963	0,377	360 0,750
PSD LF band, $msec^2$	981 197	670 125	*-310* *153**	0,404	0,982	0,82	0,370	0,218	635 0,468
PSD VLF band, $msec^2$	1261 197	963 147	*-298* *185*	0,408	0,991	0,39	0,535	0,750	1262 0,561
Microbial count for St. aur., B/Ph	60,0 1,1	63,0 1,3	*+3,0* *1,3**	0,411	0,999	0,03	0,866	0,445	61,6 0,160
Popovych's Adaptation Index-1	1,24 0,08	1,44 0,09	*+0,20* *0,10**	0,410	0,996	0,18	0,968	0,725	1,71 **0,245**
AP MC(AVL) Laterality, %	+0,2 0,4	-1,1 0,6	*-1,3* *0,7*	0,412	1,000	0,01	0,904	0,730	0 1,9
Shape Coefficient GDI Right (f), un	13,28 0,25	13,71 0,25	*+0,43* *0,23*	0,411	0,999	0,05	0,832	0,726	14,30 0,114
Entropy GDI Left	3,83 0,03	3,77 0,03	*-0,05* *0,02**	0,412	1,000	10^{-3}	0,968	0,725	3,75 0,038
Chakra 3 Asymmetry	0,15 0,06	0,02 0,06	*-0,13* *0,07*	0,410	0,996	0,18	0,670	0,717	0,06 **0,23**

On the basis of the raw coefficients and constant (Table 7), the individual values of the canonical discriminant roots were calculated with the following visualization in Fig. 6.

Table 7. Standardized and raw coefficients and constant for discriminant variables

	Coefficients	
Variables	**Standardized**	**Raw**
Bactericidity vs E. coli, 10^9 B/L	-0,321	-0,018
SDNN HRV, msec	0,131	0,006
Chakra 7 Asymmetry	0,595	2,180
Testosterone standardized, Z	0,523	0,513
T6-β PSD, %	0,423	0,022
Cortisol, nM/L	-0,382	-0,002
T3-β PSD, $\mu V^2/Hz$	-1,210	-0,009
Asymmetry-δ, %	-0,437	-0,015
T5-α PSD, $\mu V^2/Hz$	-0,891	-0,057
F3-β PSD, $\mu V^2/Hz$	1,037	0,015
Killing Index vs E. coli, %	-0,670	-0,082
Triiodothyronine, nM/L	0,318	0,354
Bactericidity vs St. aur., 10^9 B/L	-0,390	-0,025
T6-θ PSD, $\mu V^2/Hz$	-0,296	-0,281
	Constant	8,671
	Eigenvalue	1,429
Squared Mahalanobis Distance=5,52; $F_{(14)}$=4,5; $p<10^{-4}$		
Canonical R=0,767; Wilks' Λ=0,4117; $\chi^2_{(14)}$=45; $p<10^{-4}$		

As we can see, the reaction to both Phytocomposition and Naftussya water drinking takes place in almost all participants with some exception (Fig. 6), although the severity of the reaction has significant individual differences (Fig. 7), which is quite natural similar to the variety of responses to stress [44].

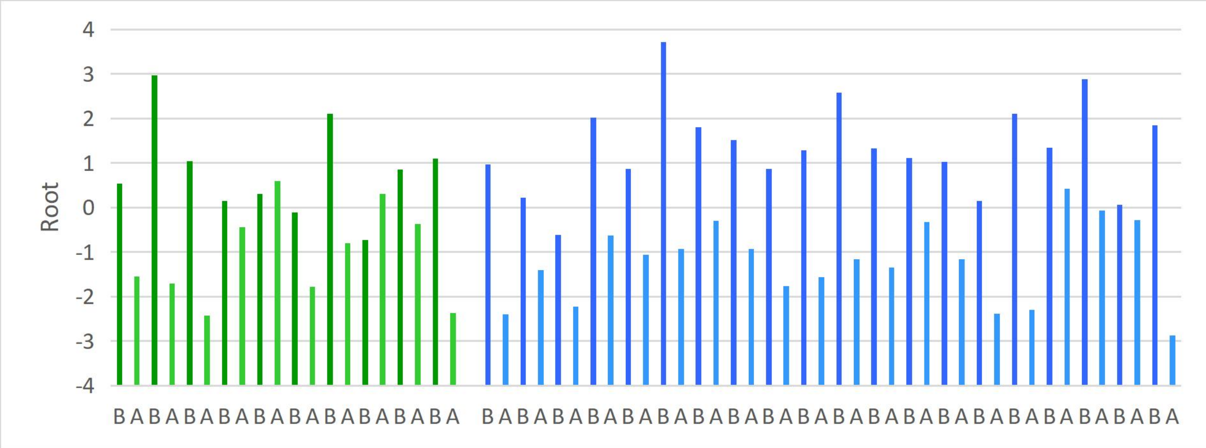

Fig. 6. Individual values of discriminant Root before (B) and after (A) course of intake of the Phytocomposition or the Naftussya water. ***A smaller column height reflects a decrease in variables positively correlated with the root, but an increase in variables inversely related to the root (please see Table 2)***

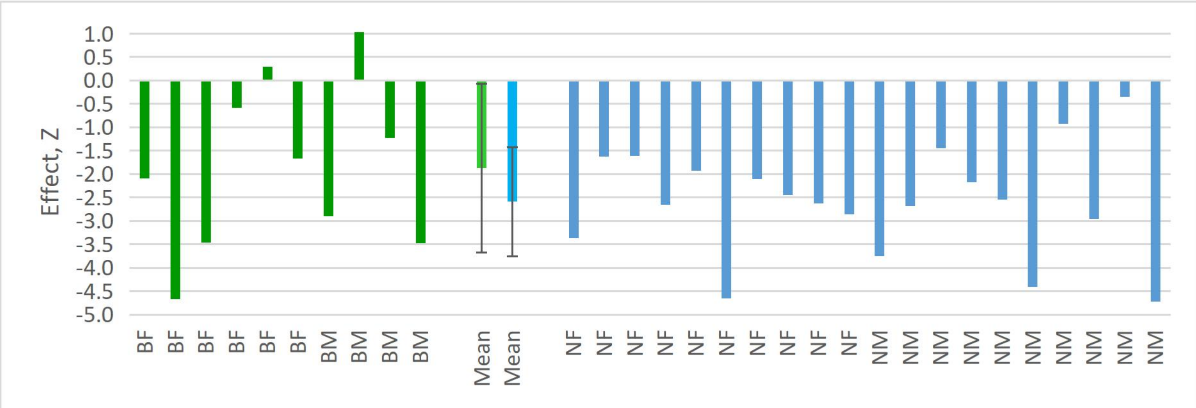

Fig. 7. Individual and average (Mtfn±SE) changes in discriminant Root at Female (F) and Male (M) caused by intake of the Balm (B) or the Naftussya water (N)

No significant differences were found either for both sexes (Fig. 7) or for adaptogen nature (Fig. 8).

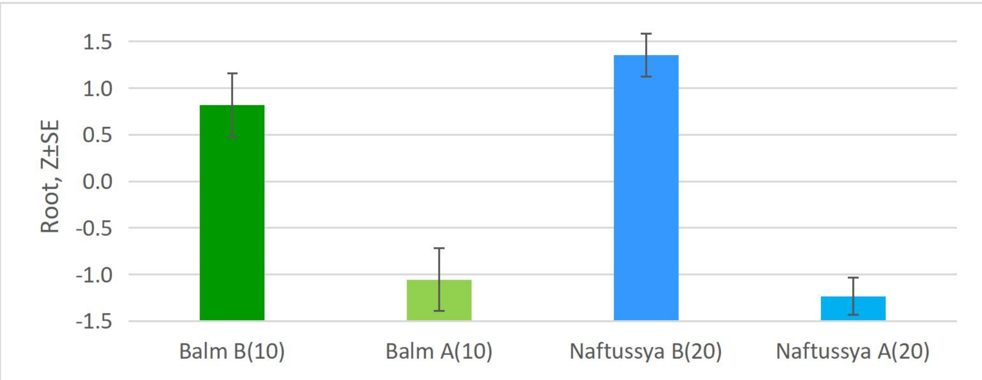

Fig. 8. Average (M±SE) values of discriminant Root before (B) and after (A) course of use of the Balm and the Naftussya water

The accuracy of the retrospective classification of phytocomposition effects by calculating individual classification functions based on its coefficients and constants (Table 8) is 90% (Table 9).

Table 8. Coefficients and constants of classification functions

Clusters	Before	After
Variables	**0,500**	**0,500**
Bactericidity vs E. coli, 10^9 B/L	-0,408	-0,366
SDNN HRV, msec	0,391	0,378
Chakra 7 Asymmetry	-8,295	-13,42
Testosterone standardized, Z	-2,603	-3,808
T6-β PSD, %	0,074	0,022
Cortisol, nM/L	0,057	0,063
T3-β PSD, μV^2/Hz	0,031	0,053
Asymmetry-δ, %	0,177	0,214
T5-α PSD, μV^2/Hz	0,604	0,739
F3-β PSD, μV^2/Hz	-0,011	-0,046
Killing Index vs E. coli, %	1,608	1,800
Triiodothyronine, nM/L	-1,373	-2,204
Bactericidity vs St. aur., 10^9 B/L	0,893	0,951
T6-θ PSD, μV^2/Hz	2,081	2,741
Constants	-87,54	-107,9

Table 9. Classification Matrix

Group	Percent Correct	B p=,50000	A p=,50000
	Rows: Observed classifications Columns: Predicted classifications		
Before	90,0	27	3
After	90,0	3	27
Total	90,0	30	30

The main provisions were discussed in the process of their presentation. It is time to move on to other positions.

It seems that the adaptogenic effect is accompanied, first of all, by a **moderate** increasing the level of circulating catecholamines and sympathetic shift in the autonomic balance as a result of an increase in sympathetic tone and a reciprocal decrease in vagal tone. There is an opinion that caused by polyphenols adrenomimetic effect of both "Balm Kryms'kyi" and ginseng tincture (similar to adrenalin as control) on the isolated heart of a frog [1] due to inhibition of catechol-o-methyltransferase activity [36].

However, I'm inclined to the neurogenic mechanism of the adreno-sympathomimetic effect of the adaptogens revealed in this study. This is consistent with literature data on the direct neurotropic effect of phytoadaptogens in vitro and in vivo [39-41], as well as both newly presented and previously published [16-17, 35,46-49] data on changes in EEG parameters.

The figures presented by Winkelmann T et al [56] give us reason to assume that the loci C3/C4 projected precentral gyrus, T3/T4 – inferior temporal gyrus, F3/F4 - caudal anterior cingulate cortex or rostral middle frontal gyrus, F7/F8 – pars triangularis or superior frontal gyrus P3/P4 – supramarginal gyrus, T5/T6 – transverse temporal cortex. The **thickness** of these cortical structures is positively correlated with the HF HRV as marker of vagal tone. However, according to presented data, an increase in **electrical activity**, or more precisely PSD, of neurons that project to the listed loci is accompanied by a moderate, within the normal range, decrease in vagal tone, as well as plasma levels of testosterone and triiodothyronine in combination with a moderate increase in the levels of cortisol and circulating catecholamines. This is consistent with the concept that adaptogens are **eustress** inducers that prevent the development of **distress** under the influence of pathogenic factors [42].

In previous studies of our laboratory, in line with the concept of the neuro-endocrine-immune complex [45], relationships between EEG and HRV, EEG&HRV and adaptogene hormones, EEG&HRV and immunity parameters were tracked in detail [21,28,31-35,46-50].

With regard to the mechanism of the neurotropic action of phytochemicals, in particular polyphenols, author suggest the mediating role of aryl hydrocarbon receptors of neurons [27,37]. The possibility of irritation by phytochemicals of the chemoreceptor terminals of the afferent vagal fibers in the intestine with subsequent influence on the activity of CNS neurons should not be rejected [13].

In conclusion, we will discuss the place and role of bioelectrophotonics and acupuncture parameters in the adaptogenic effects of the adaptogens. Previously, it was shown in our laboratory that GDV parameters significantly correlate with parameters of the neuro-endocrine-immune complex [2-5,7-8] and acupuncture points [6] and respond to the influence of both Naftussya bioactive water [22] and phytocomposition [15]. Opposite changes in the symmetry of the third and seventh Chakras, electrical conductivity of acupuncture points MC(AVL) (represent the immune system) and PSD of α- and β-rhythm PSD as well as unidirectional changes in PSD T6-β the were found in this study.

According to Ayurveda **third** Chakra associated with **celiac plexus ganglion** and **spleen** as well as [endocrine] pancreas, liver, gall bladder, stomach, duodenum, pancreas; **seventh** Chakra associated with **right** (paired EEG loci) and upper brain as well as pineal gland [12]. Therefore, these parameters of bioelectrophotonics and acupuncture logically fit into the structure of the anti-inflammatory cholinergic reflex [12].

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Accordance to ethics standards. Tests in patients are carried out in accordance with positions of Helsinki Declaration 1975, revised and complemented in 2002, and directive of National Committee on ethics of scientific researches. During realization of tests from all participants the informed consent is got and used all measures for providing of anonymity of participants.

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