Original Article

Causal relationships between the parameters of gas discharge visualization and principal neuroendocrine factors of adaptation

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Abstract:

Background. Previously we shown by means of 20 observations of 10 practically healthy men aged 26-56 years that between the eight basic parameters of gas discharge visualization (GDV, kirlianogram, elektrophotonics), on the one hand, and serum levels of triiodothyronine (T_3), testosterone, cortisol and mineralocorticoid activity estimated by serum Na/K-ratio, on the other hand, exist closely canonical correlation ($R=0,947$; $\chi^2_{(40)}=59$; $p=0,028$). The **aim** of present investigation is revision obtained results on broadened **material and research methods.** We observed twice ten women and ten men aged 33-76 years without clinical diagnose. In the morning in basal conditions at first registered kirlianogram by the method of GDV by the device “GDV Chamber” (“Biotechprogress”, SPb, RF). For further analysis the following parameters were selected: Area, Coefficient of Shape as ratio Square Length of outward contour gas discharge image to its Area as well as Entropy of contour in Right, Frontal and Left projections registered both with and without polyethylene filter. Estimated also Energy and Asymmetry of virtual Chakras. Then registered parameters of heart rate variability (HRV) by the hardware-software complex “Cardiolab+VSR” (“KhAI Medica”, Kharkiv, Ukraine). Whereupon determined blood levels of Cortisol, T_3 , Testosterone, Aldosterone and Calcitonin (by the ELISA). Results processed by method of canonical analysis, using the software package “Statistica 5.5”. **Results.** Among hormones coefficient of canonical correlation (R) parameters of GDV with Testosterone makes 0,81 ($p<10^{-5}$), with Cortisol 0,66 ($p<10^{-4}$), with Calcitonin 0,61 ($p<10^{-3}$), with Triiodothyronine 0,60 ($p=0,007$), with Aldosterone 0,48 ($p=0,022$). Among parameters HRV closely correlated with GDV constellation Bayevskiy’s Stress Index ($R=0,80$; $p<10^{-5}$) and LF/HF Ratio ($R=0,76$; $p<10^{-4}$). Coefficient of canonical correlation between Neuroendocrine constellation, on the one hand, and parameters of GDV, on the other hand, makes 0,970 ($R^2=0,941$; $\chi^2_{(198)}=264$; $p<0,001$). **Conclusion.** We confirmed that between principal neuroendocrine factors of adaptation and parameters of GDV exist strong canonical correlation suggesting informativeness this method for estimation at least adaptation and its changes.

Key words: gas discharge visualization, heart rate variability, cortisol, testosterone, aldosterone, triiodothyronine, calcitonin.

Introduction

Back in 1880 Nikola Tesla demonstrated that when placing the man in the high-frequency field around the body there is a bright glow. In 1892 YO Nardkevych-Yodko recorded glow human hands on photographic plate. However, a well-known method of "high-frequency photography" was due to spouses SD and VH Kirlian who in 1939 independently discovered this phenomenon, later called "Kirlian effect" [cit. by: 17]. In 1996 KG Korotkov created a new scientific approach, based on the digital videotechnics, modern electronics and computer processing quantitative data, called as method gas discharge visualization (GDV bioelectrography). Parallel uses the terms kirlianography and electrophotonics [17,18]. Since ambiguous attitude to the method, in 2010 we launched a study on its verification. First, we found links between parameters GDV and HRV as well as blood pressure at 8 volunteers [20,21]. In the next study [1,5-7] we shown by means of 20 observations of 10 practically healthy men aged 26-56 years that between the eight basic parameters of GDV, on the one hand, and serum levels of triiodothyronine (T_3), testosterone and cortisol as well as mineralocorticoid activity (MCA) estimated by serum Na/K-ratio, on the other hand, exist closely canonical correlation ($R=0,947$; $\chi^2_{(40)}=59$; $p=0,028$). In particular T_3 determines the parameters of GDV by 64% ($R=0,80$), testosterone by 23% ($R=0,48$), MCA by 16% ($R=0,40$), cortisol by 12% ($R=0,35$).

Our separate studies with distilled water in vitro [10] give reason to believe that changes of GDV parameters of the human body are realized through changes GDV its water, which is about 2/3 of body weight.

The **aim** of present investigation is revision obtained results on broadened material and research methods.

Material and research methods

The object of observation were 20 volunteers: ten women and ten men aged 33-76 years without clinical diagnose but with dysfunction of neuro-endocrine-immune complex and metabolism, characteristic for premorbid (intermediate between health and illness) state.

In the morning on an empty stomach we 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. The first base parameter of GDV is area of gas discharge image (GDI) in Right, Frontal and Left projections registered both with and without polyethylene filter. The second base parameter is a coefficient of shape (ratio of square of length of external contour of GDI toward his area), which characterizes the measure of serration/fractality of external contour. The third base parameter of GDI is entropy, id est measure of chaos. It is considered that GDI, taken off without filter, characterizes the functional changes of organism, and with a filter characterizes organic changes. Program estimates also Energy and Asymmetry of virtual Chakras [17,18].

Then we recorded during 7 min electrocardiogram in II lead to assess the parameters of heart rate variability (HRV) (hardware-software complex "CardioLab+HRV" production "KhAI-Medica", Kharkiv, Ukraine). For further analysis the following parameters HRV were selected. Temporal parameters (Time Domain Methods): the standart deviation of all NN intervals (SDNN), coefficient of variation (C_V), the square root of the mean of the sum of the squares of differences between adjacent NN intervals (RMSSD), the percent of interval differences of successive NN intervals greater then 50 ms (pNN_{50}), triangular index (HRV TI); heart rate (HR), moda (Mo), the amplitude of moda (AMo), variational sweep ($MxDMn$). Spectral parameters (Frequency Domain Methods): spectral power density (SPD) bands of HRV: high-frequency (HF, range $0,4 \div 0,15$ Hz), low-frequency (LF, range $0,15 \div 0,04$ Hz), very low-frequency (VLF, range $0,04 \div 0,015$ Hz) and ultra low-frequency (ULF, range $0,015 \div 0,003$ Hz) [8,9,12]. Expectant as classical indexes: LF/HF , $LFnu=100\% \cdot LF/(LF+HF)$ and Centralization Index ($CI=(VLF+LF)/HF$), Baevskiy's Stress Index ($BSI=AMo/2 \cdot Mo \cdot MxDMn$) as well as Baevskiy's Activity Regulatory Systems Index (BARS) [8].

At last in portion of venous blood serum we determined levels of Cortisol, Aldosterone, Testosterone, Triiodothyronine and Calcitonin (by the ELISA with the use of analyzers "Tecan" and "RT-2100C" and corresponding sets of reagents from "Алкор Био" Ltd, XEMA Co. Ltd and DRG International Inc.) [13]. Every day four people were tested. A week later, all the tests were repeated. Results processed using the software package "Statistica 5.5".

Results and discussion

Fragments results published as abstracts [2-4].

According to the formula:

$$|r| \geq \{ \exp[2t/(n-1,5)^{0,5}] - 1 \} / \{ \exp[2t/(n-1,5)^{0,5}] + 1 \},$$

for a sample of 40 observations critical value of correlation coefficient module at $p < 0,05$ ($t > 2,02$) is 0,31, at $p < 0,01$ ($t > 2,70$) is 0,41, at $p < 0,001$ ($t > 3,55$) is 0,52.

To visualize correlations we should decide concerning factor (argument) and effective (function) parameters. In terms of mathematics it does not matter, while in terms of physiology there is the perennial problem of cause and effect. According to existent ideas, Chakras are power centers, related to the endocrine glands and neural plexus as well as to some organs. In particular, the first Chakra is related to the testicles and sacral plexus, second Chakra to the ovaries, adrenals and kidneys, third Chakra to spleen, liver and solar plexus, fourth Chakra to thymus, heart and cardial plexus, fifth Chakra to thyroid and parathyroid glands, sixth Chakra to pituitary gland and brain, seven Chakra to pineal gland [23]. Accordingly, and based on the biblical postulate that "The beginning was the Word ...", that is, information/energy, we have chosen as a factor GDV parameters.

Revealed that serum Testosterone moderately positively correlated, especially, with Entropy GDI in Left projection (Fig. 1).

Fig. 1. Relationship between Entropy Gas Discharge Image in Left projection (axis X) and serum Testosterone (axis Y)

It should be noted that men serum Testosterone was in range 6,4÷19,2 nM/L (norm 9,5÷20,1 nM/L), in one case it was 4,5 nM/L (norm 9,5 nM/L), while in women serum Testosterone was in range 1,6÷4,8 nM/L (norm 0,05÷4,6 nM/L). Thus at women Entropy Left in 16 of 20 tests was less than 3,8.

Also found a moderate positive correlation serum Testosterone with Area GDI in Frontal projection with filter and with Shape coefficient GDI in Left projection. Contrary to expectation, we found no connection serum Testosterone with Chakra 1, while detected with Chakra 3 Asymmetry as well as Chakras 5 and 7 Energy (Table 1). Taken together, these parameters GDV determine serum Testosterone level by 57% (Table 1 and Fig. 2).

Table 1. Regression Summary for Dependent Variable: Testosterone

R=0,805; R²=0,648; Adjusted R²=0,571; F_(7,3)=8,4; p<10⁻⁵; Std. Error of estimate: 3,2 nM/L

		Beta	St. Err. of Beta	B	St. Err. of B	t ₍₃₂₎	p-level
	r		Intercept	-109	28,9	-3,76	,001
EL	0,47	,197	,132	5,88	3,94	1,49	,145
AF f	0,42	,481	,140	,00092	,00027	3,44	,002
Ch3A	0,38	,294	,109	4,62	1,72	2,69	,011
SL	0,29	,770	,235	,896	,273	3,28	,003
Ch5E	0,25	,309	,166	5,05	2,71	1,87	,071
Ch7E	-0,30	-,303	,183	-6,25	3,78	-1,65	,108
Sym	-0,26	,583	,201	,583	,201	2,90	,007

Abbreviations of GDV parameters: A - Area, E - Entropy, Sym – Symmetry, S – Shape coefficient, R – Right projection, F – Frontal projection, L – Left projection, f – with filter, Chakras (Ch) Energy [E=(R+L)/2] and Asymmetry (A=R-L).

Fig. 2. Canonical correlation between GDV parameters (axis X) and serum Testosterone (axis Y)

Instead, were met expectations regarding the key adaptation hormone cortisol, which level in serum moderately but significantly correlated with Chakra 2 Asymmetry, which, as noted, is related to the adrenals, as well as with Chakra 6 Asymmetry and Energy, which is related to pituitary gland (ACTH) and brain (CRH) (Fig. 3 and Table 2).

Fig. 3. Relationship between Chakra 6 Asymmetry (axis X) and serum Cortisol (axis Y)

Table 2. Regression Summary for Dependent Variable: Cortisol

R=0,663; R²=0,440; Adjusted R²=0,393; F_(3,4)=9,4; p<10⁻⁴; Std. Error of estimate: 223 nM/L

		Beta	St. Err. of Beta	B	St. Err. of B	t ₍₃₆₎	p-level
	r		Intercept	688	46	15,0	10 ⁻⁶
Ch6A	0,59	,476	,136	688	197	3,50	,001
Ch6E	0,39	,208	,135	204	133	1,54	,133
Ch2A f	-0,31	-,261	,126	-304	146	-2,08	,045

Both Chakras together determine Cortisol serum level by 39% (Table 2 and Fig. 4).

Fig. 4. Canonical correlation between GDV parameters (axis X) and serum Cortisol (axis Y)

Once fully consistent with the concept of Chakras regulatory role Calcitonin serum level, which source is as C-cells of the thyroid gland (related to Chakra 5) and thymus (related to Chakra 4). Both Chakras together determine Calcitonin serum level by 32% (Table 3 and Fig. 5).

Table 3. Regression Summary for Dependent Variable: Calcitonin

$R=0,613$; $R^2=0,375$; Adjusted $R^2=0,323$; $F_{(3,4)}=7,2$; $p<10^{-3}$; Std. Error of estimate: 2,8 ng/L

		Beta	St. Err. of Beta Intercept	B	St. Err. of B	$t_{(36)}$	p- level
	r			-24,2	11,95	-2,02	,050
Ch5A	0,38	,354	,132	5,83	2,17	2,68	,011
Ch4A f	0,37	,341	,132	4,48	1,74	2,58	,014
EF f	0,34	,338	,132	8,39	3,27	2,56	,015

Fig. 5. Canonical correlation between GDV parameters (axis X) and serum Calcitonin (axis Y)

Instead, for the main thyroid hormone Triiodothyronine we have not found connections with Chakra 5, but only with Chakras 1 and 7 (Table 4) as well as with Area GDI in Frontal and Left projections, which together determine Triiodothyronine serum level by 27% (Table 4 and Fig. 6).

Table 4. Regression Summary for Dependent Variable: Triiodothyronine

$R=0,603$; $R^2=0,364$; Adjusted $R^2=0,270$; $F_{(5,3)}=3,9$; $p=0,007$; Std. Error of estimate: 0,77 nM/L

		Beta	St. Err. of Beta Intercept	B	St. Err. of B	$t_{(34)}$	p- level
	r			7,84	2,39	3,28	,002
Ch1A	-0,40	-,257	,150	-1,021	,595	-1,71	,096
Sym	-0,32	-,398	,185	-,0726	,0337	-2,15	,038
AF	-0,27	-,605	,417	-,00016	,00011	-1,45	,156
AL	-0,26	,639	,436	,00020	,00013	1,47	,152
Ch7A	0,28	,492	,188	1,527	,584	2,62	,013

Fig. 6. Canonical correlation between GDV parameters (axis X) and serum Triiodothyronine (axis Y)

And absolutely poorly was associated with GDV parameters Aldosterone serum level (Table 5 and Fig. 7).

Table 5. Regression Summary for Dependent Variable: Aldosterone

$R=0,481$; $R^2=0,232$; Adjusted $R^2=0,168$; $F_{(3,4)}=3,6$; $p=0,022$; Std. Error of estimate: 15 pM/L

		Beta	St. Err. of Beta	B	St. Err. of B	$t_{(36)}$	p-level
	r		Intercept	117	251	0,47	,64
EF	-0,40	-,314	,157	-32,1	16,0	-2,00	,05
Ch6A f	-0,26	-,231	,147	-12,9	8,3	-1,56	,13
Sym f	0,27	,173	,156	2,65	2,39	1,11	,28

Fig. 7. Canonical correlation between GDV parameters (axis X) and serum Aldosterone (axis Y)

Baevskiy's Stress Index is an integral parameter of the autonomic nervous system. Established that it is closely correlated with a number of options EEG, including spectral power density of δ -rhythm in the loci: O1 ($r=0,68$); Fp1 ($r=0,67$); T5 ($r=0,66$); T6 ($r=0,66$); O2 ($r=0,49$) as well as with amplitude of δ -rhythm ($r=0,54$) and modal frequency of α -rhythm ($r=-0,44$); Canonical $R=0,80$ [22]. It is not surprising that Baevskiy's Stress Index is related to Chakra 6 (Fig. 8 and Table 6), which, in turn, is connected with brain.

Fig. 8. Relationship between Chakra 6 Asymmetry (axis X) and Baevskiy's Stress Index (axis Y)

Chakra 6 together with Chakras 5, 2 and 3 determines Baevskiy's Stress Index by 57% (Table 6 and Fig. 9). Interestingly, the components Baevskiy's Stress Index associated with GDV parameters less crowded. Canonical correlation coefficients are for Moda 0,617 ($R^2=0,381$; $AdjR^2=0,329$; $F_{(3,4)}=7,4$; $p<10^{-3}$), for AMo as sympathetic marker 0,701 ($R^2=0,491$; $AdjR^2=0,417$; $F_{(5,3)}=6,6$; $p<10^{-3}$), for MxDMn as vagal marker 0,630 ($R^2=0,397$; $AdjR^2=0,347$; $F_{(3,4)}=7,9$; $p<10^{-3}$). Triangular Index as marker of vagal tone associated with GDV parameters even weaker: $R=0,483$; $R^2=0,234$; $AdjR^2=0,170$; $F_{(3,4)}=3,7$; $p=0,021$.

Temporal HRV parameters as others markers of vagal tone on the strength of canonical correlation with GDV parameters were ranked in the following order. C_V ($R=0,661$; $R^2=0,437$; $AdjR^2=0,335$; $F_{(6,3)}=4,3$;

$p=0,003$); SDNN ($R=0,505$; $R^2=0,255$; $AdjR^2=0,193$; $F_{(3,4)}=4,1$; $p=0,013$); RMSSD ($R=0,341$; $R^2=0,116$; $AdjR^2=0,093$; $F_{(1,4)}=5,0$; $p=0,031$; pNN_{50} ($R=0,331$; $R^2=0,110$; $AdjR^2=0,086$; $F_{(1,4)}=4,7$; $p=0,037$).

Table 6. Regression Summary for Dependent Variable: Stress Index

$R=0,795$; $R^2=0,633$; Adjusted $R^2=0,566$; $F_{(6,3)}=9,5$; $p<10^{-5}$; Std. Error of estimate: 126 units

		Beta	St. Err. of Beta	B	St. Err. of B	$t_{(33)}$	p- level
	r		Intercept	3593	1878	1,91	,064
Ch6A	0,58	,339	,120	327	115	2,83	,008
Ch6E	0,48	,982	,419	643	274	2,35	,025
Ch5E	0,35	-,705	,419	-443	263	-1,68	,102
Ch2A f	-0,39	-,219	,126	-170	98	-1,74	,091
Ch3A f	-0,35	-,189	,111	-153	90	-1,71	,097
Sym f	-0,33	-,197	,111	-36	20	-1,77	,085

Fig. 9. Canonical correlation between GDV parameters (axis X) and Baevskiy's Stress Index (axis Y)

SPD HF band HRV as spectral marker of vagal tone [8,9,12,15,16,19] is also poorly associated with GDV parameters, and the correlation is stronger for the relative SPD ($R=0,568$; $R^2=0,323$; $AdjR^2=0,245$; $F_{(4,3)}=4,2$; $p=0,007$) than absolute SPD ($R=0,408$; $R^2=0,166$; $AdjR^2=0,121$; $F_{(2,4)}=3,7$; $p=0,034$).

It is speculated that absolute SPD LF band HRV reflects mainly Sympathetic outflow or both Sympathetic and Vagal origin, while relative SPD is seen as more likely marker of sympathetic tone [9,12]. As mentioned fourth Chakra is related to thymus, **heart and cardial** plexus [23]. It is noteworthy that absolute SPD LF band correlates with Asymmetry and Energy of fourth Chakra, which together with Area of GDI in the Right projection determines its by 34% (Table 7).

Table 7. Regression Summary for Dependent Variable: LF absolute

$R=0,623$; $R^2=0,388$; Adjusted $R^2=0,337$; $F_{(3,4)}=7,6$; $p<10^{-3}$; Std. Error of estimate: 851 msec²

		Beta	St. Err. of Beta	B	St. Err. of B	$t_{(36)}$	p- level
Intercept	r			4239	1147	3,69	,001
Ch4A	-0,39	-,200	,140	-651	456	-1,43	,162
Ch4E f	0,32	,548	,164	2585	775	3,33	,002
AR	-0,25	-,526	,159	-,168	,051	-3,31	,002

Stronger and more numerous links with GDV parameters found for relative SPD LF band, primarily with the Area of GDI in the Left projection (Fig. 10, Table 8).

Fig. 10. Relationship between Area GDI in Left projection (axis X) and relative SPD LF band HRV (axis Y)

Table 8. Regression Summary for Dependent Variable: LF relative

R=0,729; R²=0,531; Adjusted R²=0,428; F_(7,3)=5,2; p<10⁻³; Std. Error of estimate: 10 %

		Beta	St. Err. of Beta	B	St. Err. of B	t ₍₃₂₎	p- level
	r		Intercpt	220	61	3,63	,001
AL	-0,51	-1,141	,365	-,0052	,0017	-3,13	,004
AF	-0,37	1,280	,457	,0050	,0018	2,80	,009
AF f	-0,34	-,875	,288	-,0045	,0015	-3,04	,005
CAK	0,41	,885	,255	11,34	3,26	3,48	,001
SR f	0,36	-,313	,246	-3,079	2,417	-1,27	,212
SF f	0,33	-,174	,225	-1,267	1,640	-,77	,446
SR	0,30	-,242	,293	-,826	1,001	-,82	,415

In general, the higher sympathetic tone, the smaller the area of GDI and the higher its Shape coefficient and Coefficient of activation (CAK), introduced by KG Korotkov [17,18]. Taken together these GDV parameters determines relative SPD LF band HRV by 43% (Table 8).

Table 9. Regression Summary for Dependent Variable: VLF absolute

R=0,661; R²=0,437; Adjusted R²=0,314; F_(7,3)=3,55; p=0,006; Std. Error of estimate: 2042 msec²

		Beta	St. Err. of Beta	B	St. Err. of B	t ₍₃₂₎	p- level
	r		Intercpt	-15759	9034	-1,74	,091
Ch3A f	0,39	,288	,171	2989	1781	1,68	,103
Ch1E	0,38	,370	,157	2915	1239	2,35	,025
CH6A f	0,32	,810	,504	6909	4302	1,61	,118
CH5A f	0,28	-,853	,500	-6749	3952	-1,71	,097
EF	0,27	,562	,219	8754	3415	2,56	,015
EL	0,27	-,285	,235	-4226	3472	-1,22	,232
Ch4 A	-0,28	-,325	,153	-2500	1175	-2,13	,041

There is speculation that VLF band (0,04÷0,015 Hz) HRV associated with oscillation blood levels of **renin** (0,04 Hz) and epinephrine (0,025 Hz), reflects **thermoregulatory** cycles [cit. by: 9,19], cerebral ergotropic and metabolotropic outflows [cit. by: 8], activation of cerebral sympathetic-adrenal system [cyt. by: 14], sympathetic activity [cit. by: 16]. In support of these assumptions prove identified in this cohort links between VLF and **Aldosterone** (r=-0,33) as well as **Triiodethyronine** (r=0,24).

Regarding the absolute SPD VLF band we found no connection with Chakra 2, instead found with Chakras 5 and 6 related to Thyroide gland, Hypophyse and Brain as well as with Chakras 3, 1 and 4, whith together determines its by 31% (Table 9 and Fig. 11).

Fig. 11. Canonical correlation between GDV parameters (axis X) and SPD VLF band HRV (axis Y)

Instead, relative SPD VLF band is associated with both Chakras 5 and 6, and with Chakra 2, whith together with Chakra 4 determines its by 37% (Table 10).

Table 10. Regression Summary for Dependent Variable: VLF relative

$R=0,669$; $R^2=0,448$; Adjusted $R^2=0,367$; $F_{(5,3)}=5,5$; $p<10^{-3}$; Std. Error of estimate: 14 %

		Beta	St. Err. of Beta	B	St. Err. of B	$t_{(34)}$	p- level
	r		Intercept	59,2	2,7	21,8	10^{-6}
Ch1A f	0,39	,351	,139	33,5	13,3	2,53	,016
Ch4A f	0,30	,232	,129	15,7	8,7	1,80	,081
Ch6E	0,29	,333	,132	20,4	8,1	2,52	,017
Ch5A f	0,28	,245	,130	14,1	7,5	1,89	,067
Ch2A f	-0,33	-,233	,135	-16,9	9,8	-1,72	,095

It is speculated that ULF band ($0,015\div 0,003$ Hz) HRV associated with oscillation blood level of norepinephrine (0,002 Hz) as well as 17-OCS (0,0019 Hz) [cit. by: 19]. In support of these assumptions prove identified in this cohort links between ULF and Cortisol ($r=0,23$).

We found no connection its with Chakra 2, instead found with Chakras 4 and 6 related to cardiac plexus, Hypophyse and Brain, whith together with Chakra 5 determines absolute SPD ULF band by 35% (Table 11 and Fig. 12).

Table 11. Regression Summary for Dependent Variable: ULF

$R=0,658$; $R^2=0,433$; Adjusted $R^2=0,349$; $F_{(5,3)}=5,2$; $p=,0012$; Std. Error of estimate: 123 msec²

		Beta	St. Err. of Beta	B	St. Err. of B	$t_{(34)}$	p- level
	r		Intercept	-4632	1847	-2,51	,017
Ch5E	0,34	,241	,140	121	70	1,72	,095
Ch6A f	0,34	,268	,133	142	70	2,01	,052
Ch6A	0,28	,261	,141	201	109	1,84	,074
Sym f	0,30	,349	,137	50	20	2,55	,015
Ch4A f	-0,31	-,267	,132	-154	76	-2,03	,051

Fig. 12. Canonical correlation between GDV parameters (axis X) and SPD ULF band HRV (axis Y)

LF/HF ratio is another integral parameter of the autonomic nervous system reflecting sympathetic-vagal balance. Established that it is correlated with a number of options EEG, including index of α -rhythm ($r=-0,32$) and its asymmetry ($r=0,30$), modal frequency of θ -rhythm ($r=-0,34$), relative SPD P4- β ($r=0,37$), C3- β ($r=0,36$), P3- α ($r=-0,33$) as well as absolute SPD C3- α ($r=-0,32$), F3- α ($r=-0,31$), F4- α ($r=-0,3$) and T5- θ ($r=0,31$); Canonical $R=0,56$ [22]. Nevertheless, we found no connection LF/HF ratio with Chakra 6, while it is determined by Shape coefficients in Left and Frontal projections as well as by Entropy GDI in Frontal projection by 51% (Table 12 and Fig. 13).

Table 12. Regression Summary for Dependent Variable: LF/HF

$R=0,755$; $R^2=0,570$; Adjusted $R^2=0,507$; $F_{(5,3)}=9,0$; $p<10^{-4}$; Std. Error of estimate: 3,9

		Beta	St. Err. of Beta	B	St. Err. of B	$t_{(34)}$	p- level
	r		Intercept	-89,4	21,3	-4,19	,0002
SL	0,49	1,648	,380	2,148	,496	4,33	,0001
EF f	0,39	,294	,119	11,71	4,74	2,47	,0186
SF	0,37	-,714	,294	-,750	,309	-2,43	,0205
AL	-0,29	,679	,254	,0013	,0005	2,68	,0114
Ch1A	-0,28	-,377	,122	-9,19	2,96	-3,11	,0038

Fig. 13. Canonical correlation between GDV parameters (axis X) and LF/HF ratio HRV (axis Y)

At the final stage, we analyzed the relationships between the two constellations parameters.

Table 13. Chi-Square Tests with Successive Roots Removed

	R	R ²	χ^2	df	p	Λ Prime
0	,970	,941	264	198	,001	<10⁻⁴
1	,958	,918	198	168	,055	<10 ⁻³
2	,918	,842	141	140	,462	,002

Table 14. Canonical Analysis Summary. Factor Structure

Right set	Root 1	Root 2	Root 3	Left set	Root 1	Root 2	Root 3
Ch3 Asymmetry	,47	,21	-,05	Testosterone	,77	-,07	-,44
Entropy Left	,40	-,12	-,36	Cortisol	-,69	,24	-,44
Ch3 Asymmetry f	,37	,07	-,07	Stress Index	-,58	-,00	-,52
Ch2 Asymmetry f	,36	,09	,21	Aldosterone	,08	,65	-,09
Shape coeffic. Left	,36	-,15	-,00	T3	,06	,34	-,01
Ch7 Asymmetry	,30	,19	-,17	VLF	-,09	,19	-,39
Area Frontal f	,25	,03	-,47	LF/HF	,34	-,36	-,36
Shape coeff Frontal	,24	-,04	-,09	Calcitonine	-,09	-,28	-,45
Ch6 Asymmetry	-,39	-,04	-,62	ULF	,00	,11	-,68
Ch7 Energy	-,35	-,02	,00				
Ch5 Asymmetry	-,32	,12	-,35				
Area Left	-,24	,14	-,20				
Ch6 Energy	-,23	,14	-,55				
Symmetry	-,22	-,03	,13				
Entropy Frontal f	,09	-,46	-,29				
Entropy Frontal	,11	-,30	-,28				
Ch4 Asymmetry f	-,05	-,19	,13				
Ch6 Asymmetry f	,11	-,19	-,36				
Ch1 Asymmetry	-,01	-,06	,05				
Symmetry f	,13	,37	,04				
Ch5 Energy	-,02	,08	-,57				
Area Frontal	-,00	,02	-,33				

The program has selected 22 GDV parameters (right set) and 9 neuro-endocrine parameters (left set), information of which condensed to three pairs of canonical roots (Table 13).

As seen in Table 14, GDV Root 1 (major) receives positive factor load from eight options, including Chakras 3, 2 and 7, and negative load from six settings, including the Chakras 6, 7 and 5, while corresponding neuro-endocrine Root includes information on key factors of adaptation, which is determined GDV parameters by 94% (Table 13 and Fig. 14).

Fig. 14. Correlation between the first canonical roots GDV parameters (axis X) and neuro-endocrine parameters (axis Y)

GDV Root 2 (minor) receives factor load from six others settings, which determines others neuro-endocrine parameters by 92% (Table 13 and Fig. 15).

Fig. 15. Correlation between the second canonical roots GDV parameters (axis X) and neuro-endocrine parameters (axis Y)

The third pair of canonical roots is not worthwhile because of the p-level.

We consider it necessary to bring the correlation matrix (Table 15).

Table 15. Correlations, left set with right set

p<0,05; p<0,01; p<0,001

Neuro-endocrine parameters	GDV parameters: A - Area, E - Entropy, Sym – Symmetry, S – Shape coefficient, F – Frontal projection, L – Left projection, f – with filter									
	AF	AF	Sym	Sym	EF	EF	SF	AL	EL	SL
Testosterone		,42	-,26			,25			,47	,29
Cortisol				-,33						
Stress Index				-,38	,25	,39	,37	-,29	,36	,49
LF/HF			-,35	,27	-,40	-,28				
Aldosterone										
T3	-,27		-,32				,25	-,26		,28
Calcitonine				-,29		,34				
ULF	,25	,25		,30					,26	
VLF					,27				,27	

Prolongation of table 15

Neuro-endocrine parameters	Gas Discharge Visualization parameters: virtual Chacras Asymmetry (A) and Energy (E)											
	Ch1 A	Ch2 Af	Ch3 A	Ch3 Af	Ch4 Af	Ch5A E	Ch5 E	Ch6A Af	Ch6 Af	Ch6 E	Ch7A E	Ch7 E
Testosterone			,38	,25			,25				,27	-,30
Cortisol		-,31				,43		,59		,39		
Stress Index		-,39	-,33	-,35		,46	,35	,58		,48		
LF/HF	-,28											
Aldosterone									-,26			
T3	-,40										,28	
Calcitonin					,37	,38		,37				
ULF				,26	-,31		,34	,28	,34	,34		
VLF				,39					,32	,28		

We cherish the hope that confirmed that between principal neuroendocrine factors of adaptation and parameters of GDV exist strong canonical correlation suggesting informativeness this method for estimation at least adaptation and its changes.

Earlier at this contingent we have shown that due to the use of bioactive water Naftussya as adaptogene factor GDV parameters are changed [11]. The next article will examine relationships these changes with changes of neuroendocrine-immune complex and metabolism.

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Accordance to Ethics Standards

Tests in patients are conducted 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.

For all authors any conflict of interests is absent.

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