

## THE EFFECT OF VARNA SEA-COAST CLIMATIC FACTORS ON NEURO-VEGETATIVE REACTIVITY

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The effect of Black sea-coast factors on various functions of healthy individuals and persons with various affections has been the objective of a number of investigations in Bulgaria (1, 2, 3, 4, 5). The alterations of the neuro-vegetative reactivity under the effect of climatic factors of the sea-shore region is of special interest, for it greatly contributes to the elucidation of the mechanism by which these factors influence and modify the various functions of the organism.

### Method

Our studies were performed on a series comprising 53 men with average age 38,1 years, at rest at the Varna sea-shore sanatorium. Individuals were selected mainly with functional disturbances of the nerve system, the predominating complaints being of neuro-vegetative nature. The clinical diagnosis of almost all individuals was "neurosis — neurasthenia" in all its varieties.

The subjective complaints in the majority of patients investigated were headache, irritability, general fatigability, organic sensations, limb numbness: less than half the patients were complaining of vertigo, noise in the ears, loss of appetite, low spirits and frequent nervous fits. The subjective complaints in the beginning and at the end of sanatorial stay for the entire group observed are presented in table 1.

The neuro-vegetative reactivity was established by means of the electrophoretic dermogram method (EPhDG). The skin electroconductivity was measured with galvanometer Multiflex ( $2.10^{-7}$  A, 60 ohm). The evaluation of neuro-vegetative reactivity, according to the EPhDG, was carried out after the proposed by Daskalov, Markov and Milarov pattern (6, 7, 8). Simultaneously, the pulse rate was also measured for a duration of one minute periods, as well as the blood pressure after the method of Korotkov (with the Riva-Roci apparatus). In addition changes in body weight were registered, orthostatic test was carried out as well as counting of leukocytes with differential determination of the white blood picture. For the analysis lymphocytic and eosinophilic count per 1 cc blood was utilized.

All examinations were repeatedly performed. The first time 1 — 2 days after admitting at the sanatorium, and the second time — 1 or 2 days before dismissal. All the turns were of 20 days' duration. The in-

Table 1

Subjective complaints	At the beginning						At the end					
	with complaints		without complaints		Irregular		with complaints		without complaints		Irregular	
	N <sup>o</sup>	%	N <sup>o</sup>	%	N <sup>o</sup>	%	N <sup>o</sup>	%	N <sup>o</sup>	%	N <sup>o</sup>	%
Headache	41	77,4	10	18,9	2	3,7	7	15,2	28	52,8	18	33,9
Insomnia	39	73,6	8	15,1	6	11,3	4	7,6	8	15,1	6	11,3
Irritability	47	88,7	6	11,3	—	—	3	5,7	21	39,6	29	54,7
Fatigability	43	81,1	10	18,9	—	—	2	3,7	36	67,8	15	28,3
Organic sensations	38	71,7	15	28,3	—	—	2	3,7	25	47,2	26	49,1
Vertigo and noise in the ears	19	35,9	27	50,9	7	13,2	2	3,7	38	71,1	13	24,5
Limb numbness	29	54,7	24	45,3	—	—	2	3,7	36	67,8	15	28,3
Appetite	13	58,5	4	7,6	18	33,1	39	73,6	2	3,7	12	22,6
Mood/spirits	15	28,3	18	33,9	20	37,7	33	62,3	1	1,9	19	35,9
Fits	4	7,6	49	92,4	—	—	1	1,9	51	96,2	1	1,9

dividuals liable to investigation were picked up from the winter turns, which arrived in the first four months of 1963. The studies were carried out from 9 to 13 o'clock in the morning.

### Results and discussion

The persons investigated, grouped according to the type of EPhDG at the beginning and at completion of the stay in the sanatorium, are illustrated in table 2. Of all the EPhDG patterns at admittance, the largest relative part appertains to the "low curves" (79,4%), next ranking the "mean curves" (13%) and "acetylcholine dissociation" (5,7%). Only one case was observed with "adrenalin dissociation" (1,9%).

At the end of the sanatorial stay, 38 of the investigated (71,7%) display an unaltered pattern of EPhDG with respect to the results of primary investigation. This group includes the individuals originally included in the "low curves" type. From the remainder none preserved the initial EPhDG type. At the end of the stay most outstanding of the newly obtained types is the group of the "low curves" (13%), followed by the "mean curves" (9,4%), "acetylcholine dissociation" (3,8%) and "adrenalin dissociation" (1,9%).

The summarized EPhDG curves, common for all individuals investigated and for the various patterns, are illustrated in the uppermost line of figure 1. At the lower part of the same figure the summarized curves are seen, common and according to the EPhDG type of the same individuals, based on the data received at the end of sanatorial stay and regardless of the fact that in 28,3% of the investigated the curve type compared to the initial one was not preserved.

The acetylcholine and adrenalin values of the "low curves" type (Fig. 1-a) at completion of the turn are but slightly higher as compared to the values at the beginning. At the end of the rest period, the "mean curves" (Fig. 1-b) disclose a decrease of the acetylcholine and adrenalin values, mostly manifested at the first measurement and relatively more pronounced for the adrenalin (more than two times). In the "acetylcholine dissociation" (Fig. 1-c) a decrease is observed of the acetylcholine values and increase of adrenalin values, the maximum of the adrenalin curve being recorded at the second measurement. The "adrenalin dissociation" is present in one case only, which at the end of the rest period was altered in "low curve". Here the adrenalin and acetylcholine values are markedly decreased (Fig. 1-d). Particularly strong is the reduction of adrenalin values thereby accounting for the markedly decreased adrenalin curve. It is quite evident from the analysis of the summarized curves of all the individuals studied (Fig. 1-e), that the final acetylcholine and adrenalin values are decreased as compared to the same values obtained at the first measurement.

In table 3 the mean arithmetical values are given for the EPhDG in compliance with the index, pulse rate, blood pressure, number of eosinophils and lymphocytes (in absolute figures) per 1 cc blood, weight

Table 2

Types of EPHDG	Initial EPHDG		Changes of the EPHDG at the end of the stay									
	number of individuals	% of the total number	low curves		mean curves		adrenalin dissociation		acetylcholine dissociation		unchange d EPHDG type	
			N.	%	N.	%	N.	%	N.	%	M	N.
Low curves	42	79,4	—	—	3	7,1	—	—	1	2,4	38	90,5
Mean curves	7	13	5	71,4	—	—	1	14,3	1	14,3	—	—
Acetylcholine dissociation	3	5,7	1	33,3	2	66,7	—	—	—	—	—	—
Adrenalin dissociation	1	1,9	1	100	—	—	—	—	—	—	—	—
Total	53	100	7	X	5	X	1	X	2	X	38	X
% of the total individuals observed	X	X	7	13	5	9,4	1	1,9	2	3,8	38	71,7

and results of the orthostatic test at the beginning and at the end of sanatorial stay for all the individuals studied.

Based on the results of the comparative evaluation of the first and second examination, the conclusion is reached that the EPhDG index, pulse rate and eosinophilic number remain unaltered. The mean arithmetical for the lymphocytic count, systolic and diastolic blood pressure

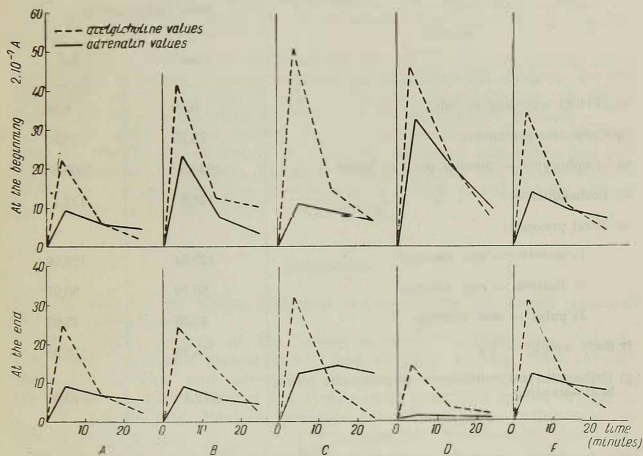


Fig. 1

A — low curves; B — mean curves; C — acetylcholine dissociation; D — adrenalin dissociation; E — summarized curve for all the individuals investigated.  
 ..... acetylcholine values  
 ————— adrenalin values

at the second examination are decreased as compared to the first one. While at admission at the sanatorium the increase of the pulse rate with the change of the body position from recumbent to standing averaged +12,1 pulse waves per minute for the total group, at the end this index was decreased to 10.5 pulse waves per minute.

We should like to emphasize that at completion of the turns none of the subjects studied was discharged from the sanatorium in a worsened condition. Seven of the individuals under observation were unchanged (13%). The remainder displayed various degrees improvement, including definite amelioration. The state of subjective complaints at dismissal are illustrated in the second part of table 1. By confrontation the data in both parts of the table, it becomes clearly evident that the sanatorial stay has accounted for a marked subsiding of subjective complaints.

The data obtained, chiefly according to the EPHDG method, show that the sojourn along the Varna sea-coast during the winter brings about a decrease in the high values of adrenalin and acetylcholine, which is an expression of normalization of the increased sympathetic reactivity.

Table 3

INDICES	Mean Arithmetical values	
	Initial	final
a) EPHDG according to index	0,69	0,69
b) Pulse rate per minute	75,72	75,70
c) Lymphocytes — number per 1 cc blood	1934,5	1606,3
d) Eosinophils — " " "	124,8	122,1
e) Blood pressure :		
1) systolic — mm. mercury	129,34	123,99
2) diastolic — mm. mercury	83,99	80,97
3) pulse — mm. mercury	45,35	43,02
f) Body weight — Kg	73,26	73,95
g) Orthostatic test — difference in pulse rate recumbent—standing	+12,1	+10,5

This tendency towards general normalization of neurovegetative reactivity with respect to the various types is doubtlessly determined, firstly, by the general regimen at the sanatorium and, secondly, by the climatic complex which also exerts influence on the organism.

We feel that the relationship between the negatively and positively charged ions in the atmosphere is the factor of greatest importance among the entire climatic complex, affecting the organism. It is well known that the skin covering the human body is charged with negative electricity. In atmospheric conditions with predominance of negative ions, its polarization properties get intensified, thereafter leading to a marked reduction of the inherent receptors' excitation. The skin represents a huge receptor surface which registers all the changes in the meteorological factors of the external environment. Thus it could be assumed that the strong polarization of the skin, which occurs in the instance of prevalence of the negatively charged ions in the atmosphere, is the factor which to a greater extent could account for the intensity reduction of organism reactions. An attenuation of the nerve system excitation results, leading subsequently to abatement of the phenomena established by a certain degree nervous tension. A similar theoretical ex-

planation is also acceptable for the alterations noted in the blood pressure. The reduction of the orthostatic reflex at the end of the period could also be related to the already emphasized by us decrease in sympathetic reactivity. The data on lymphocytic count, in accordance to the significance of this particular index for the condition of the neuro-vegetative reactivity, also confirms this statement.

There are literature data proving that there exists an alteration in the ions relationship with prevalence of the negatively charged ions along the Black sea coast (9). It is mostly manifested in the midday hours.

The not so strong and clear-cut changes of the climatic indices along the Varna sea coast, which represent a characteristic feature for the sea coast climate in general, very likely also contribute for the reduction of the neuro-vegetative reactivity of the individuals studied.

If the latter fact is proved, it may be possible in future examinations to control, by means of a specially designed apparatus for artificial ionization of the air, the relationship between the negatively and positively charged ions in a restricted area, which would not be without significance as far as therapy is concerned.

### Inferences

The stay in the Varna sea-coast region during the winter accounts for the alteration of:

1) EPhDG pattern of the "mean curves", "acetylcholine dissociation" and "adrenalin dissociation", and in 9,5% — the "low curves". Both acetylcholine and adrenalin values are decreased, which fact is interpreted as attenuation of the sympathetic reactivity in the organism.

2) Systolic and diastolic pressure is reduced. The orthostatic reflex is delayed from 12,1 to 10,5. The absolute lymphocytic count per 1 cc blood falls from 1934,5 to 1606,3.

A theoretical explanation is proposed of the mechanism by which the functions of the organism are influenced by climatic factors; a particular importance is attributed to the prevalence of the negatively charged ions, leading to an increase of skin polarization and decrease of the proper receptors' excitability with respect to environmental factors.

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## ВЛИЯНИЕ КЛИМАТИЧЕСКИХ ФАКТОРОВ ВАРНЕНСКОГО ПОБЕРЕЖЬЯ НА НЕВРОВЕГЕТАТИВНУЮ РЕАКТИВНОСТЬ

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### РЕЗЮМЕ

Исследованы были 53 мужчины, отдыхающие в приморском санаториуме у города Варна, с целью установления невроvegetативной реактивности. Использован метод электрофоретической дермограммы (ЭФДГ), измерялись частота пульса, кровяное давление, вес, проводилась ортостатическая проба, подсчитывались лейкоциты и проводился дифференциальный подсчет белой картины крови.

Было установлено, что ЭФДГ в 9,3 процентов „низких кривых“ и при всех остальных типах изменяется, причем стоимости адреналина и ацетилхолина снижаются. После пребывания в санаториуме снижаются систолическое и диастолическое кровяное давление, ортостатический рефлекс и число лимфоцитов, что рассматривается как снижение повышенной симпатикусовой реактивности.

Теоретически, наблюдаемые явления ставятся в связь с влиянием новой обстановки санаториального режима и с климатическими факторами. Придается значение преобладанию отрицательно заряженных ионов в атмосфере, в их соотношении с положительными ионами, что увеличивает поляризацию кожи и уменьшает возбудимость ее рецепторов, в отношении факторов внешней среды.