

Ecology

Influence of Electromagnetic Field on Locomotor- and Emotion-Motivated Behavior in Animals in “Open Field”. Stimulatory Action of the Preparation *Seratonus*

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ABSTRACT. Herbal preparation *seratonus* regulates attitude to risk in animals, relieves emotional state, activates metabolism of those biologically active substances, which determine both changes in behavioral actions and rats' high tolerance to stressors. © 2010 Bull. Georg. Natl. Acad. Sci.

Key words: *vegetable composition, Wistar rats, open field.*

Each change in living conditions affects psychophysiological processes occurring in living organisms and their anatomy [1-3]. Not all the changes are desirable for the development and preservation of life on the earth. Therefore one's attention is given to the study of the effect of electromagnetic radiation caused by human activity on living organisms [4-9]. At the same time levelling of unwanted processes by various biologically active substances becomes necessary, in particular, vegetable compositions. For this purpose we use herbal preparation *seratonus*. Ascertainment of the influence of industrial frequency electromagnetic field on living organisms and their nervous system (NS) is particularly relevant, because neurochemical and physiological correlates of changes caused by EMF are not always clear. All this creates a need for new researches. Taking into consideration all the above-said we decided to investigate the behavior of Wistar rats under the influence of communication frequency EMF in “open field” (OF) and stimulation effect of the composition *seratonus* on their motivated emotional behaviour.

Material and Methods. An open field is a round chamber with diameter 120 cm divided into 42 equal

sectors. While conducting experiments the open field was brightly illuminated with a light source (200 W) located 1m above the chamber. Duration of each observation session lasted for 180 sec. Results of observation were processed by a computer equipped with a special program.

To assess locomotor activity of animals we detected the following parameters: time spent to go out of the central zone; the number of crosses from one square to another; average rate of translocation, the number of translocation cycles and the time spent on translocation. Oriental-exploratory activity was estimated with rearing and an average time spent for one rearing. Emotional activity of rats was estimated by the number of urination and faeces (droppings); stereotyped activity – by the number of grooming cycles, total time spent on groomings, etc.; amount of immobility cycles, average time for one cycle, etc. were observed as well.

Experiments were performed on Wistar rats. The animals were divided into control (A and C) and experimental (B and D) groups. They were given food and water at standard conditions (barley, maize, sunflower seeds, cabbage, carrot, polyvitamins “Undevit”, bread and milk).

Experimental rats, in addition, were given the preparation *seratonus*.

The experiment was carried out by means of the original induction coil (750 mm in diameter and 2200 mm in length). It has some sections of turns and power supplies of two types. The first one is used to influence with network frequency high strength stationary electromagnetic field, and the second – universal supply – to influence with stationary and simulated electromagnetic field.

Large sizes of the coil allow us to study complete forms of behavior and their autonomic correlates directly influenced by electromagnetic field. The animals were examined under 2h-interrupted action of electromagnetic field (1.5 mT inductivity, 50 Hz frequency). In 5 hours after exposure the rats were removed from the coil.

Results and Discussion. The study of the behavior of the control rats and the rats fed with the preparation *seratonus* revealed a difference in their activity of movement. Latent period of movement from the central circle was more in control rats (A group) than in experimental rats (B-group) (4.8 ± 0.8 sec against 1.9 ± 0.6 sec). A-group rats crossed more cells than B-group ones (47.8 ± 5.0 and 41.6 ± 2.0 respectively) (see Table). The difference is seen in translocation time and in percentage of the translocation time calculated from total time spent on the experiment. From the above-said it follows that experimental rats move slower and spend more time in average to cross cells – 49.6 % instead of 35%. Such a conclusion will be confirmed if we consider

the number of immobility cycles. The Table shows that this index in control rats is lower than in experimental rats (4.0 sec and 14.8 sec respectively). Besides, in the open field, control and experimental rats differ from each other in orientation activity as well. Number of rearings in experimental rats is 12, in control – 18. Average time of rearings for experimental rats is 1.7 sec., for control – 0.9 sec. Study of stereotype activity showed that the number of groomings in control and experimental rats is equal, but to make one grooming cycle rats of B-group spend 10.5 sec, and control rats – 4.9 sec.

Thus, on the basis of our data we can conclude that rats fed with vegetable composition are characterized by low emotionality, which is revealed in small quantity of boluses and urination, large quantity of groomings and low number of translocations, which is in accordance with literary data [4-6].

As for the animals which were affected by electromagnetic field (1.5 mT inductivity, 50 Hz frequency) (see Table), the animals of C control group spend more time to leave the central zone than experimental rats; (3.7 ± 0.5 sec and 5.7 ± 0.4 sec respectively); the number of cross sections is noticeably more for control rats than for the experimental group (40.9 ± 0.5 and 55.1 ± 2.9 respectively); this shows that they move faster; they have also very high number of rearings especially in the central and neighbouring sections (20.8 ± 1.0 and 14.8 ± 0.6 respectively). This can be explained by the fact that they do not think about the danger, and their orientational

Table

Behaviour of control and experimental rats in the open field and under the electromagnetic field influence

№№	Behaviour of rats	A Control	B Experimental	C Control in el.magn. fiel	D Experimental in el.magn. field	P _{A-B}	P _{C-D}
1	OF central circle leaving time	4.8 ± 0.8	1.9 ± 0.6	3.7 ± 0.5	5.7 ± 0.4	<0.05	<0.05
2	Number of lines crossing the arena	47.8 ± 5.0	41.6 ± 2.0	55.1 ± 2.9	40.9 ± 0.5	<0.05	<0.01
3	Translocation specific time of total test period, %	35.0 ± 4.0	49.6 ± 4.2	38.0 ± 3.5	45.8 ± 0.6	<0.001	<0.001
4	Immobility time	4.0 ± 0.5	14.8 ± 0.2	12.1 ± 1.8	16.8 ± 0.3	<0.01	<0.01
5	Immobility specific time of total test period, %	22.9 ± 4.2	52.3 ± 4.7	30.2 ± 4.0	50.9 ± 0.7	<0.001	<0.001
6	Number of rearings	18.0 ± 1.0	12.0 ± 0.5	20.8 ± 1.0	14.8 ± 0.6	<0.001	<0.001
7	Rearing time in average	0.9 ± 0.2	1.7 ± 0.3	4.4 ± 0.2	1.9 ± 0.5		<0.05
8	Total time of groomings	4.9 ± 0.3	10.5 ± 2.1	6.8 ± 3.1	9.6 ± 0.3	<0.05	<0.05
9	Average number of grooming cycles	14.0 ± 0.1	10.1 ± 0.2	18.5 ± 0.7	7.4 ± 0.5	<0.05	<0.001
10	amount of boles	1.5 ± 1.0	1.0 ± 0.1	8.0 ± 0.2	6.0 ± 0.4		<0.05
11	Urination frequency	2.3 ± 0.2	1.0 ± 0.1	2.5 ± 0.1	1.5 ± 0.4	<0.05	<0.001

reflexes are intensified, urination and boluses are significantly increased (see Table). If we observe these data, we can see that behaviour of animals of D group fed with *seratonus* and that of B group are almost the same. This fact can point to decrease of the stress state, which mainly characterizes animals being affected by electromagnetic field. Time spent on translocation is 38.5% for control C group, and 45.8% for experimental D group fed with *seratonus*. Immobility time is increased too and equals 12.1 sec for control and 16.8 sec for

experimental group. Specific time of immobility out of the total time of experiment is also increased – it equals 30.2% for control and 50.9% for experimental rats. Retard action processes are evident but they are not significantly different for the rats of D group.

Hence one can conclude that herbal preparation *seratonus* controls the attitude to risk in animals, relieves emotional state, activates metabolism of those biologically active substances which determine both changes in behavioral acts and rats' high tolerance to stressors.

ეკოლოგია

ელექტრომაგნიტური ველის ზემოქმედება ცხოველების მოძრაობით და ემოციურ-მოტივაციურ ქცევაზე “ღია ველში”. მცენარეული პრეპარატ სერატონუსის მასტიმულირებელი მოქმედება

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მცენარეული პრეპარატი სერატონუსი არეგულირებს ცხოველებში საფრთხისადმი დამოკიდებულებას; ხსნის ემოციურ მდგომარეობას, ააქტიურებს იმ ბიოლოგიურად აქტიურ ნივთიერებათა მეტაბოლიზმს, რომლებიც განსაზღვრავენ როგორც ქცევითი აქტების ცვლილებებს, ასევე ვირთაგვების მაღალ შემგუებლობას სტრესორების მიმართ.

REFERENCES

1. G. Magradze, M. Kakabadze, M. Nikolaishvili (2003), Bull.Georg.Acad.Sci., **168**, 1: 131-133.
2. M. Nikolaishvili, M. Jojua, G. Magradze, I. Maisuradze (2006), Proc. Georg. Acad. Sci. Ser.Biol.A, **32**, 1: 71-75.
3. T. Soloshvili, T. Dzamashvili, G. Magradze, M. Nikolaishvili (2003), Actual Problems of Biology and Medicine, 2: 361-365.
4. N. Kafkafi (2003), Behav. Res.Methods Instrum.Comput., **35**(2): 294-301.
5. I. Golani (2005), Proc. Natl. Acad. Sci. USA, **102**(12): 4619-24.
6. D. Lipkind, A. Sakov, N. Kafkafi et al. (2004), J.Appl. Physiol., **97**(1): 347-59.
7. Yu.G. Grigor'ev (2003), Radiatsionnaya Biologiya, Radioekologiya, **43**, 5: 541-543 (in Russian).
8. A.G. Tamasidze, M.I. Nikolaishvili (2006), Georgian Medical News, 12: 91-94.
9. A. Auvinen, M. Hietanen, R. Luukkonen et al. (2002), Epidemiology, 13: 356-359.

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