GENETICS

Differential Blood Count and Activity of Lymphocytic Dehydrogenases in Rats with Genetically Different Neuroendocrine Status

N. I. Gryazeva, M. V. Robinson, N. N. Barykina, A. V. Shurlygina, V. G. Kolpakov, and V. A. Trufakin

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Differential blood count and activity of lymphocytic dehydrogenases are studied in rats genetically liable to catalepsy and in Wistar rats. The activity of lymphocytic dehydrogenases is decreased, sex differences in activities of the studied enzymes leveled, and absolute counts of peripheral blood lymphocytes are decreased in rats liable to catalepsy.

Key Words: *dehydrogenases; lymphocytes; abnormal higher nervous activity*

Study of the immune function in disorders of higher nervous activity is important for elucidat on of the mechanisms of neuroimmune relationships and for developing the methods for diagnosis and treatment. The search for a "marker" reflecting shifts in the functions of both systems is a priority task. Lymphocyte morphology and metabolism represent morphological equivalent of the immune system function and reflect metabolic processes in the organism [7]. Previously, we demonstrated a relationship between changes in animal behavior, levels of cerebral monoamines, and activities of blood lymphocyte dehydrogenases [1]. In 1975 an outbred strain genetically predisposed to cataleptic reaction to stress (GC) was selected from a Wistar rat subpopulation [12]. Neurophysiological and neurochemical parameters of these animals are similar to those observed in amphetamine intoxication and some other human psychopathological states.

We compared cellular composition of the blood and lymphocytic enzymes in GC and Wistar rats.

Institute of Clinical and Experimental Lymphology, Siberian Division of the Russian Academy of Medical Sciences, Novosibirsk

MATERIALS AND METHODS

Experiments were carried out on male and female GC (27th generation of selection) and Wistar rats aged 4-5 months weighing 160-200 g. Blood lymphocyte dehydrogenases: succinate (SDH), lactate (LDH), and α-glycerophosphate dehydrogenases (GPDH) were measured by quantitative cytochemical method [6] using nitroblue tetrazolium. Thirty cells per smear and the mean number of formasane granules per cell were counted. Dehydrogenase activities in male and female GC rats were compared to those in male and female Wistar rats. Differential blood count for the examined populations was determined in the smears stained by the method of Romanovskii [7]. Significance of the results was assessed using nonparametrical Wilcoxon—Mann—Whitney's test.

RESULTS

The activities of all studied lymphocytic enzymes were lower in GC rats than in male Wistar rats (Table 1). SDH, LDH, and GPDH activities in female GC rats were virtually the same as in Wistar rats and had a trend to increase. In Wistar rats, the activities of

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Table 1. Activities of Blood Lymphocyte Enzymes in GC and Wistar Rats (granule/lymphocyte, *M±m*)

Rats	SDH	LDH	GPDH
Wistar			
males	13.24±0.49	13.24±0.38	9.36±0.35
females	10.6±0.31*	12.7±0.43	7.71±0.29*
GC			
males	10.88±0.22**	12.84±0.28**	7.74±0.2**
females	11.7±0.23	14.36±0.38	8.45±0.21

Note. *$p>0.95$, **$p>0.99$ *vs.* Wistar males.

Table 2. Cellular Composition of the Blood in GC and Wistar Rats (*M±m*)

Rats		Nuclei-containing cells/ml×10^6	Lymphocytes, %	Segmented leukocytes, %	Absolute count of lymphocytes/ml
Wistar	males	10.5±2.6	87.0±3.24	11.67±3.89	916.0±248.3
	females	6.5±0.61	78.0±3.94*	19.0±2.55*	490.0±38.5*
GC	males	9.0±0.46+	77.14±2.34+	20.71±2.29+	690.29±23.83
	females	6.71±0.72**	65.8±6.49*	29.7±5.85	424.2±38.42**

Note. *$p>0.95$, **$p>0.99$ *vs.* males in the same group, +$p>0.95$ *vs.* Wistar males.

SDH and GPDH in males and females were different, while the activity of LDH did not depend on sex. In GC rats, there were no sex-specific differences in the activities of the studied enzymes.

The count of nucleated cells, percentage of lymphocytes, and absolute count of lymphocytes were significantly lower and the percentage of segmented leukocytes higher in GC than in Wistar rats; 3 out of 4 parameters of differential blood count were different in males and females (Table 2).

These results can be explained by decreased levels of dopamine and noradrenalin in GC rats [12]. Changed ratio of neurotransmitters modifies the functional activity of lymphoid cells [11]. Adrenalin and noradrenalin stimulate a number of immunological parameters. Lymphocytes and macrophages carry receptors for serotonin, dopamine, and other neuromediators [13]. Therefore, decreased activities of blood lymphocyte dehydrogenases in GC rats can be caused by decreased activities of adrenergic and dopaminergic compartments of the central nervous system. Decreased level of monoamines in GC rats may result in a lower intensity of cell proliferation in the central immune organs [13], which may cause a decrease in the relative and absolute counts of peripheral blood lymphocytes. Serotonin and dopamine cause redistribution of cells between the immune system organs, which also can lead to relative and absolute lymphopenia in GC rats [11].

A tendency to a decrease in blood testosterone level, manifesting itself in stress, was observed in male GC rats [10]. Decreased testosterone level may contribute to leveling of sex-specific differences in lymphocytic dehydrogenase activities in GC rats, while sex differences in the quantitative composition of blood cells were not leveled.

SDH level in rat brain structures correlates with animal behavior [8]. In humans, the activities of brain and blood lymphocyte dehydrogenases closely correlate in diseases of the central nervous system; depressed activities of blood oxidative enzymes can indicate electroencephalogram changes and deviations in psychomotor functions [4,9]. Presumably, in our experiments activities of blood lymphocyte dehydrogenases reflected the parameters of energy metabolism in the central nervous system.

Thus, enzymatic spectrum of lymphoid cells can be regarded as an important diagnostic and prognostic parameter in studies of abnormalities of higher nervous activity caused by disordered behavioral reactions.

REFERENCES

1. N. I. Gryazeva, M. V. Robinson, and V. A. Trufakin, *Byull. Sib. Otdeleniya Rossiisk. Akad. Med. Nauk.* No. 4, 45-47 (1994).
2. L. V. Devoino and E. L. Al'perina, *Farmakol Toksikol.*, No. 5, 590-592 (1980).
3. V. G. Kolpakov, *Catatonia in Animals: Genetics, Neurophysiology, and Neurochemistry* [in Russian], Novosibirsk (1990).
4. N. E. Margolina, *Pediatriya*, No. 2, 24-27 (1981).
5. V. V. Men'shikov, *Laboratory Methods of Investigation in Clinical Practice* [in Russian], Moscow (1987).
6. R. P. Narcissov, *Arkh. Anat.*, No. 5, 85-91 (1969).
7. M. V. Robinson, L. B. Toporkova, and V. A.Trufakin, *Lymphocyte Morphology and Metabolism* [in Russian], Novosibirsk (1986).
8. K. Yu. Sarkisova, L. V. Nozdracheva, and M. A. Kulikov, *Zhu. Vyssh. Nervn. Deyat.*, **41**, No. 5, 963-972 (1991).
9. M. I. Chikovani, *Pediatriya*, No. 2, 27-28 (1981).
10. V. A. Shul'ga, *Fiziol. Zhu.*, **82**, No. 10-11, 77-83 (1996).
11. L. Devoino, *Methods Find. Exp. Clin. Pharmacol.*, **8**, No. 3, 175-181 (1986).
12. V. G. Kolpakov, *Some Genetic Animal Models for Comparative Psychology and Biological Psychiatry, Novosibirsk* (1996).
13. W. Pierpaoli and G. M. Maestroni, *J. Immunol.*, **120**, No. 5, 1600-1603 (1978).