Biological activity of the mummy. Publication 8: Adaptogenic Action. Effects on the immune system

L.N. Frolova, T.L. Kiseleva
(Institute of Homeopathy and Naturotherapy of the Federal Scientific Clinical Experimental Center for Traditional Methods of Diagnostics and Treatment of Roszdrav, Moscow)

SUMMARY

The article presents the results of an information-analytical study of the effect of mummy on: resistance of animals to various damaging factors, physical activity and immunogenesis.

Key words: mummy, adaptogenic activity, phagocytosis, phagocytic activity,phagocytic index, immunogenesis.

I. Adaptogenic activity of mummy

Since ancient times, in various traditional systems, mummy has been classified as a substance that has a positive effect on metabolic and restorative processes, contributes to the strengthening of the general resistance of the body, increasing its adaptive capabilities to various, including exogenous, negative factors. It was believed that it relieves the feeling of fatigue, acts on a living organism as a fortifying agent, helps to restore lost strength and "energy" [1], and has a tonic effect [2]. In the second half of the XX century, a number of attempts were made to scientifically substantiate the adaptive properties of mummy.

1.1. The effect of mummy on the resistance of animals to damaging factors

ON. Shelkovsky and V.A. Savenko (1965) studied the survival rate of rabbits in chronic experience in a sealed room. The studies were carried out in 4 series.Series I - control; Series II - rabbits receiving oral50 mg per day of mummy for 40 days before the experiment; III series - rabbits that received oral 100 mg per day of mummy for 40 days; IV series -rabbits received orally 200 mg per day of mummy for 40 days [9].

Before the experiment, the number of erythrocytes, hemoglobin, and the initial number of breaths per minute were determined for each animal. During the experiment, each rabbit was placed in a sealed chamber with a volume of 12 liters and noted: changes in its behavior, the number of breaths every 10 minutes, the concentration of carbon dioxide in the chamber every 30 minutes. After cessation of respiration, the rabbit was removed from the chamber and the number of erythrocytes, reticulocytes, and hemoglobin was determined [9].

As a result of the research, it was found that in the control series, the life expectancy of animals averaged 81.6 minutes. InII series - increased to 98 minutes, c III - before 109.5 minutes, c IV - before 131.8 minutes In the control group, the accumulation of carbon dioxide was faster and respiratory arrest was observed at 10.6%. Stop breathing duringII series took placewhen the content of carbon dioxide in the chamber is 11.2%, in III - 11.5%, in IV - 12.8%. The results of the study indicate a correlation between the dosage of the mummy preparation and the rate of carbon dioxide accumulation: the larger the dose of mummy received by rabbits, the slower the accumulation of carbon dioxide in the chamber and the more resistant the animals to hypercapnia [9].

The initial value of the number of breaths per minute in all series was in the range 112–125. After 10–20 minutes. there was an increase in breathing up to 165–178 per minute. After that, in the control group, it decreased, and in the rest, frequent breathing persisted for a long time [9]. The initial number of erythrocytes in all series ranged from 5130 thousand to 5680 thousand. At the end of the experiment in the control series, the number of erythrocytes increased by an average of 390 thousand.II series - on 360 thousand, in Series III, the increase was 690 thousand, and in IV - 1200 thousand (by 23.4%). The results of the experiment indicate a direct relationship between the dosage of the mumiyo drug and

the number of erythrocytes: the larger the dose, the more significantly the number of erythrocytes increases [9].

The initial level of hemoglobin in all series ranged from 11.5 to 13.3%. At the end of the experiment, a slight increase in the amount of hemoglobin was noted in all groups, and it was greatest in series III and IV. Thus, the results indicate a direct relationship between the dosage of the mummy drug and the amount of hemoglobin: the higher the dose, the more significantly the number of erythrocytes and the amount of hemoglobin increases [9].

Thus, long-term oral administration of Shilajit helps to increase the body's resistance in rabbits; ensures their longer stay in sealed chambers; increases the tolerance of animals to high concentrations of carbon dioxide, the accumulation of which in the body against the background of the use of mummy occurs more slowly than in the control group [9].

The lifespan of animals under these conditions is directly proportional to the dosage of the mumiyo preparation. The increased resistance of the body to oxygen starvation can be explained by an increase in the number of erythrocytes and hemoglobin in the circulating blood [9]. In other studies, N.A. Shelkovsky and V.A.Savenko (1965) studied the effect of mummy on the sensitivity of experimental animals toreduced partial pressure of oxygen in the inhaled air, that is, their ability to adapt to extreme conditions [10].

The experiments were performed on 4 groups of gray male rabbits. Group I - intactanimals; II - animals that received 50 mg of dry powder of mummy per day along with food; III -animals that received 100 mg of dry powder of mummy per day along with food; IV - animals,receiving 200 mg of dry powder of mummy per day along with food. All animals were placed in a pressure chamber, where an ascent to a height at a speed of 20 meters per second was simulated [10].

In all experimental animals, before being placed in a pressure chamber, the number of erythrocytes, reticulocytes and hemoglobin was determined. The same indicators were determined after the termination of the experiment, when respiration stopped in rabbits [10].

Observations of the behavior of animals in a pressure chamber made it possible to establish that signs of oxygen starvation (in the form of a motor reaction and convulsions) in an intact group of animals appeared at heights lying within 7-9 thousand meters. In animals of the experimental group, especially III and IV, the motor reaction was absent. The animals lay down on the bottom of the chamber, and only at an altitude of 1000 m and more did they get excited. At the same time, almost no stiffness of the occiput muscles characteristic of intact animals was observed. In animals of the experimental groups, the stage of decompensation began much faster, the increase in frequency and cessation of respiration occurred at much higher altitudes, compared with the intact group of animals [10].

During the experiment, changes were noted on the part of the red blood. In intact animals, due to continuous and rapid rise, the increase in the number of erythrocytes averaged 100 thousand in mm^3 blood. In animals of the experimental groups, the increase in the number of erythrocytes was most pronounced. There was a direct relationship between the dosage of the drug mumiyo and the number of erythrocytes:Group II, the number of erythrocytes was 720 thousand mm^3, v III and IVgroups - 750-780 thousand mm^3 [ten].

Quantitative changes in the level of hemoglobin in the blood were less pronounced: in I group the amount of hemoglobin was 0.1 g%, in II - 0.3 g%, c III - 0.5 g%, c IV - 0.6 g%. The discrepancy between the number of erythrocytes and hemoglobin is due to the fact that in the experimental groups the increase in the number of erythrocytes occurred mainly due to the entry into the peripheral blood in a large number of young forms of erythrocytes - reticulocytes, poorly saturated with hemoglobin, which indicates an increase in brain activity [10].

In intact animals, the number of reticulocytes ranged from 1.5% to 2.2%. In animals of the experimental groups, in all series of experiments before being placed in the pressure chamber, the number of reticulocytes was increased and ranged from 2.8% to 3%. When removed from the pressure chamber, the number of reticulocytes in their circulating blood increased by 500–600% in relation to the initial data [10].

Thus, the mummy increases the body's resistance to a reduced partial

the oxygen pressure in the inhaled air. This is a consequence of the more pronounced reactivity of the hematopoietic system and reduced sensitivity of the central nervous system to a lack of oxygen in the blood [10].

Yu.N. Nuraliev (1973) studied the effect of mummy on the resistance of the experimental animals (rats and white mice) to harmful agents and physical activity [4, 5]. When studying the effect of mummy on the resistance of animals to pressure chamber hypoxia and the action of high temperature (44-C), the experimental animals (white mice) were divided into three series:I group were control animals; II - animals that received the mummy orally by 100 mg / kg per day, III - animals that received the mummy orally by 300 mg / kg per day [4, 5].

When studying the effect of mummy on the resistance of animals to radiation under conditions of high-altitude hypoxia, the experimental animals (rats) were divided into seven series: I serieswere control animals, II - animals that received the mummy orally by 300 mg / kg per day, III - animals that received the mummy orally by 450 mg / kg per day, IV - animals,receiving vitamin B_6 (pyridoxine) in an amount of 50 mg / kg per day, V - animals that receivedvitamin b_{12} (cyanocobalamin) in an amount of 200 mg / kg per day, VI - animals receiving vitaminV_{with} (folic acid) in the amount of 30 mg / kg per day, VII - animals receiving diphenhydramine inthe amount of 40 mg / kg per day [4, 5].

Effect of mummy on the resistance of animals to pressure chamber hypoxia

With a single administration of mummy (before exposure to the stressor agent), the lifespan of the control animals was 162 ± 29 min. In animals of the experimental series, the lifespan increased and forII series was 200 ± 7 min. (128% to control), forIII - 269 ± 24 min. (166% to control) [4, 5].

With repeated introduction of mummy (after impact stressful agent) the lifespan of the control animals was 159 ± 19 min. Experienced animalsseries, the lifespan increased for II series was 254 ± 28 min. (159% to control), forIII - 288 ± 17 min. (181% to control) [4, 5].

The effect of mummy on the resistance of animals to high temperaturesThe

lifespan of the control animals was 16 ± 3 min. In animalsexperimental series, the lifespan increased and for II series was 22 ± 4 min. (155% to control), forIII - 28.8 ± 3 min. (188% to control) [4, 5].

The effect of mummy on the resistance of animals to the effects of radiation in high-altitude hypoxia

The life span of the control animals was 6.2 ± 0.5 days. In animalsexperimental series, the lifespan increased and for II series was 8.9 ± 0.2 days (143% to control), for III - 10.6 ± 1 min. (155% to control), forIV - 10.4 ± 2 days (151% to control), for V - 9.7 ± 0.3 days (156% to control), for VI -10.7 ± 0.3 days (172% to control), for VII - 8.1 ± 0.5 days (136% to control) [4, 5].

Thus, after a single (before exposure to a stressor agent) and multiple (after exposure to a stressor agent) administration of mummy at doses of 100, 300, and 450 mg / kg, the animals became more resilient and resistant to oxygen starvation (11 thousand m above sea level). , inside the pressure chamber), irradiation (LD_{50} X-rays), in conditions of alpine hypoxia (Anzob pass, 3375 m above sea level) and to high temperatures. The life expectancy of animals after preliminary oral administration of mummy increased from 28% to 88% ($P < 0.05–0.001$) [4, 5].

1.2. The effect of mummy on the resistance of animals to physical activity

Studied by Yu.N. Nuraliev (1973) on 100 white mice using the "hanging ropes" and "animal swimming" technique [4, 5]. The essence of the "hanging ropes" technique is as follows. Above the table are placed 10 smooth cords 40 cm long with mice. Physical endurance is judged by the time the mice are held on the cord from the moment they are placed until they fall.

them on the table surface [4, 5].

Animal swimming technique. In a bath filled to a constant level with warm water (from +18 to + 22-C), 10 control and 10 experimental white mice are placed simultaneously. Water enters the bath through a hose under pressure, which forces the animals to be in motion all the time. Each mouse swims until it is completely tired and sinks to the bottom [4, 5].

In the experiment, all experimental animals were divided into four series: I - werecontrol animals treated with saline; II - animals that received mummyorally at a dose of 50 mg / kg per day, III - animals that received mummy orally in a dose 100 mg / kg per day, IV - animals that received mummy orally in a dose 200 mg / kg per day. Experimental animals received mummy 40–50 minutes before the start of the experiment [4, 5].

The effect of mummy on the resistance of animals to physical activity, studied by the method "Hanging ropes"

In the course of the study, it was found that the animals of the control series were kept on hanging ropes for 81 ± 11.4 minutes. The duration of retention on the hanging cords in animals of the experimental series increased and forII series was 105 ± 9.6 min. (130% to control), forIII - 145 ± 7.3 min. (168% to control), forIV - 153 ± 10.4 min. (188% to control) [4, 5].

The effect of mummy on the resistance of animals to physical activity, studied by the method "Swimming animals"

The swimming time of animals in the control series was 261 ± 12.7 minutes. The swimming duration of the animals of the experimental series increased and forII series was 359 ± 5.1 min. (134% to control), forIII - 399 ± 8.6 min. (145% to control), forIV - 376 ± 7.4 min. (144% to control) [4, 5]. Thus, shilajit at a dose of 50, 100, 200 mg / kg statistically significantly lengthens the residence time of mice on hanging cords by 30–88% and increases the swimming time of mice by 34–45% compared to the control group [4, 5].

N.V. Syrovezhko (1971), studying the resistance of animals (mice) to physical activity,used a model to make them run. In the course of studies, it was found that mummy at a dose of 20–30 μg / kg increases the running time of mice by 123%, compared with the control group [6]. The presence of adaptogenic activity in mummy preparations was also confirmed in the work of R.M. Muminova. (1978) [3].

II. Effect of mummy on the immune system

Due to the fact that phagocytosis and the activity of antibody production are of great importance for the body's resistance, A.G. Shvetskiy (1991) carried out pharmacological studies in this direction [8]. Pentoxil, the most well-known and comprehensively studied stimulator of metabolic processes, which enhances the body's defenses and increases the phagocytic activity of leukocytes, was used as a reference drug. In the first series of experiments, phagocytic activity was determined in the blood of a healthy rabbit in the presence of 1% mummy solution, 1% suspension of pentoxil, and in the presence of saline. In the latter case, the phagocytic index (the percentage of neutrophils involved in phagocytosis) was 24.0 ± 2.2. When mummy was added to the incubation medium, the phagocytic index increased by 2.3 times and amounted to 54.7 ± 2.3.

In the second series of experiments, the same rabbits were injected into the stomach for three days at 75 mg / kg of mummy extract or at 33 mg / kg of pentoxil. On the fourth day, the phagocytic index was determined in animals. In the course of the study, an increase in the phagocytic index was established: upon stimulation of the mummy, it was 62.3 ± 2.5; when stimulated with pentoxil - 55.1 ± 2.4 [8].

In the third series of experiments, stimulation of phagocytosis was carried out simultaneously in vivo and in vitro. ForIn this case, the blood of rabbits that received mummy was incubated with a solution of mumiyo, and those who received pentoxil were incubated with the addition of pentoxil. An increase in phagocytic

index: with stimulation of mummy it was 64.1 ± 2.5, with stimulation with pentoxil - 57.0 ± 2.4 [8].

Thus, mummy has a pronounced effect on the phagocytic activity of neutrophils, in comparison with pentoxil, taken as a standard in the study of the phagocytic link of the immune system [8]. Shilajit is able to enhance phagocytosis not only when administered orally, but also through direct action on phagocytes. Phagocytic activity is most pronounced at the level of the organism [8].

In another series of studies, A.G. Shvetsky (1991) explored the possibility ofthe use of mummy and pentoxil to stimulate immunogenesis [8].

The research was carried out on 15 rabbits, divided into three groups. I group(control) was injected with saline; Group II consisted of rabbits receivingin parallel with immunization daily at 100 mg / kg shilajit; III - rabbits receivingin parallel with immunization daily at 100 mg / kg of pentoxil [8].

All experimental animals underwent repeated fractional immunization adsorbed antistaphylococcal toxoid at intervals of 3 days. The titer of antistaphylococcal antibodies was determined in animals at various times [8].

In the course of research, it was found that the initial titer of anti-alphatoxin in rabbits I (control group) was 0.3 AU / ml, II and III - 0. After 3 days, the titer of antialfatoxin in rabbits I (control group) and II group was - 0, III - 3.00 AU / ml. 7 days after immunization: I - 8.55, II - 6.50, III - 14.50 AU / ml; 13 days after immunization: I - 10.20, II - 18.00, III - 20.03 AU / ml; 17 days after immunization: I - 15.33, II - 38.00, III - 36.00 AU / ml; 24 days after immunization: I - 6.66, II - 14.00, III - 15.33 AU / ml [8].

Thus, the antialfatoxin titer in animals treated with stimulants was significantly higher and persisted for a long time. When studying the histomorphology of the lymph nodes and spleen in stimulated animals, signs of a more pronounced immunological restructuring of the body were found [8].

III. Conclusion

The results of the conducted information and analytical research were summarized by us in table. 1.

Table 1

Results of studying the adaptogenic action of mummy and its influence on the immune system (according to the literature)

№ п/п	Автор исследования, библиографическая ссылка	Год	Характеристика объекта исследования				Результаты исследований
			Название препарата и его концентрация	Способ и дозы введения	Опытные животные	Место отбора проб мумиё	
1.	Н.А. Шелковский и В.А. Савенко [9, 10]	1965	мумиё	перорально в дозе 50, 100 и 200 мг/кг	кролики	не указано	Способствует повышению сопротивляемости кроликов; обеспечивает более длительное нахождение их в герметичных камерах; увеличивает переносимость животными высоких концентраций углекислоты; повышает сопротивляемость организма к пониженному парциальному давлению. Продолжительность жизни животных находится в прямо пропорциональной зависимости от дозировки препарата мумиё.
2.	Ю.Н. Нуралиев [4, 5]	1973 - 1977	водный экстракт мумиё	перорально в дозе100, 300, 450 мг/кг	крысы и белые мыши	Средняя Азия, Забайкалье	Однократное и многократное введение увеличивает выносливость и устойчивость к действию кислородного голодания, в условиях высокогорной гипоксии и к воздействию высокой температуры. Увеличивает продолжительность жизни животных. от 28% до 88% (P<0,05−0,001). Удлиняет время нахождения животных на висячих канатиках на 30−88% и увеличивает продолжительность их плавания на 34−45%, по сравнению с контрольной группой.
3.	Н.В. Сыровежко [6]	1971	сухой экстракт мумиё	перорально 20-30 мкг/кг	мыши	Забайкалье	Увеличивает продолжительность бега мышей на 123%, по сравнению с контрольной группой.
4.	А.Г. Швецкий [6]	1991	экстракт мумиё	в желудок − 75 мг/кг; перорально − 100 мг/кг	кролики		Усиливает фагоцитоз при непосредственном воздействии на фагоциты. Стимулирует иммуногенез.

The mechanism of adaptogenic action of mummy, according to most authors, is associated with the presence in its composition of a complex of macro and microelements [7], with the activation of the pituitary-adrenal system [9, 10] and the presence of a neurotropic, namely, adrenopositive effect of the drug [4, 5].

The combination of the adaptogenic properties of mummy with its ability to enhance the regenerative processes of the soft and bone tissues of the body can be used to treat malnourished patients in whom the healing processes take a long time [4, 5].

The discovered ability of mummy to increase and accelerate the production of antibodies during immunization can be used to stimulate immunogenesis after conducting appropriate clinical trials of standardized drugs or biologically active food supplements.

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Author's address
Ph.D. Frolova L.N.
Institute of Homeopathy and Naturotherapy FNCEC TMDL Roszdrav
127206, Moscow, st. Vuchetich, 12a
fln1966@yandex.ru

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