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## THE IMPACT OF THE MOON PHASE ON THE BALANCE OF THE AUTONOMOUS NERVOUS SYSTEM AND THE FUNCTIONAL HEALTH OF MEN OF DIFFERENT AGE GROUPS

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### Abstract

**Introduction.** The autonomic nervous system is the main regulatory mechanism of a living organism that provides homeostasis. **Objective:** to investigate the effect of the Moon phases on the autonomic balance of the human body, the ratio of sympathetic nervous system activity to the parasympathetic nervous system and the functional health of the population. **Materials and methods.** 1592 males of different age were examined with the help of functional vegetative diagnostics according to the method of V. Makats. The bioelectric activity of 12 symmetric pairs of functionally active zones of the skin (24 FAZ), 12 on the hands and 12 on the feet, which reflect the functional activity of the sympathetic and parasympathetic nervous systems were studied. **Results.** In the male group aged 3-6 years old, the chaotic pattern of functional dependencies is related to the physiological and functional immaturity of the adaptation processes and the speed of their formation and stabilization in

the body of children. In the male group of 12-15 years old in different phases of the Moon the changes in activity indicators of functional systems with much smaller amplitude are observed, though the nature and direction of changes in activity remain similar, which indicates the stabilization of adaptation mechanisms in the body. In the male group aged 21-50 years old maximum amplitude fluctuations in the functional activity of the systems and vegetative homeostasis are observed in the new Moon and the full one, which indicates a decrease in adaptation processes associated with age-related decrease in physiological and biochemical processes in the body and the appearance of the organism in the body.

**Conclusions.** It has been established that the change of the Moon phases leads to significant changes in the functional activity and homeostasis of the body of men of different age groups. On-phase Moon activity indicators of functional systems duplicating the norm line have the same orientation, differing in amplitude, forming age-specific features of the tone of the autonomic nervous system.

**Key words: Moon; Moon phases; autonomic nervous system balance; health**

Nowadays there is no doubt that the position according to which natural cosmic-planetary fields, which are a kind of synergistic cradle of humanity, has a special and even key value to the emergence and evolution of living beings on Earth. The parameters of the physical fields in the Earth's biosphere depend primarily on the dynamics of space processes. It is known that at any given moment the cosmophysical reality is determined by the activity of the Sun, the relative location of the planets, the phases of the moon, the position of the Earth in the sectoral structure of the interplanetary magnetic field as well as galactic cosmic radiation. This, in turn, determines the following parameters: magnetic, electromagnetic, gravitational, acoustic, acoustic-gravitational, other information fields, the intensity of corpuscular flows, the electrical properties of the biosphere, in particular the quasi-static electric field of the Earth, weather conditions on Earth, etc. [1]. According to the results of numerous scientific works [2, 3], shifts of these parameters can change the functioning of organisms, affecting the physical and chemical properties of the organism molecules, in particular due to the phenomenon of nuclear magnetic resonance, enzyme activity, speed of biochemical reactions, structure and transport properties of cells activity of electro and chemosensitive ion channels, gene and cell receptor expression, neuronal excitability, biological rhythms, etc.

The evolutionary determined sequence of the interaction of various physiological and functional systems is consistent with the external environment and determines the normal life of the whole organism [4].

The autonomic nervous system (ANS) is known to be the main regulatory mechanism of a living organism that provides homeostasis [5]. Functional (physiological and pathological) oscillatory processes in the basic systems of organs are carried out on changes of internal and external environment by means of vegetatively-humoral mechanisms determining the degree of adaptive reaction of the organism [6]. The study of the human ANS status is a primary task in the conditions of adaptation of physiological and functional systems of the organism to living conditions including the one under the action of pathological factors on the organism. It is known that the evaluation of the functioning of the autonomic nervous system can serve as a physiological marker for identifying mechanisms of individual variability and the response to environmental factors (A.M. Vane, 1998).

The least studied and ambiguous environmental factor affecting the human body is the change of the moon phases, among them the young, full, the first and the second quarters. To date, there are no data in the literature regarding the effect of the phases of the Moon on the autonomic balance of the human body as well as the ratio of sympathetic nervous system (SNA) activity to the parasympathetic nervous system (PNS) and functional health of the population.

**Materials and methods of the research.** Changes in the physiological state of the body are manifested by the transformation of electro-skin resistance in certain functionally-active zones (FAZ) of the skin, which topographically coincide with the course of 12 classical acupuncture meridians (functional systems) - lungs (LU), pericardium (PC), heart (HT), colon (C), condition of the lymphatic system (TE), large intestine (LI), spleen and pancreas (SP), liver (LR), kidney (KI), bladder (BL), gall bladder (GB) and stomach (ST). The correlations between changes in electrical conductivity in 24 representative FAZ (characterizing the state of the meridian as a unity) and the state of classical acupuncture meridians "determining" the functional state of their respective internal organs and systems of the organism are used for the diagnosis.

With the help of the functional-vegetative diagnostics (FVD) according to the method of V. Makats we 1592 men of different age were examined. They were having sanatorium and health improvement in sanatoriums of Ukraine. FVD was conducted in the morning (10:00–12:00). The bioelectric activity of 12 symmetric pairs of functionally active skin zones (24 FAZ), 12 on the hands and 12 on the feet, which reflect the functional activity of the

sympathetic and parasympathetic nervous systems, was studied [7]. The FVD according to the method of V. Makats and devices for its implementation were officially approved by the Ministry of Health of Ukraine "New Medical Equipment and New Methods of Diagnosis" (№ 5 from 25.12.91; № 1.08-01 from 11.01.94) and the Scientific Council of the Ministry of Health of Ukraine (No. 1.08-01 of 11/01/94).

For FVD a VITA 01 M device is used, the voltage in the closed circuit of which does not exceed the levels of membrane potentials (1-5  $\mu$ A; 0.03 - 0.6 V). The device does not require external energy sources for its operation. It has 2 diagnostic electrodes, a base electrode acceptor of electrons (AE) - a convex plate of a special alloy, pre-coated with an oxide film (5x7 cm) and 2 paired diagnostic electrodes (DE - electron donors) in the form of a silvered pair, which are located in ebonite cups with a diameter of 1 cm and wrapped with foam gaskets. The base electrode (AE) is fixed by a special belt through a moist pad (moistened with saline solution) in the umbilical region (central mesogastric area (0-zone) with medium density tension to create stable examination conditions. Diagnostic electrodes (DE) are also moistened with saline solution. The procedure is performed in the orthostatic position of the person. In the process of testing electrodes DE at right angles with a slight pressure (at the touch level), simultaneously contact with each pair of symmetric FAZ (left-right at each extremity) for 1-4 seconds to obtain stable performance in micro amperes. Electrodes are remoistened with saline solution after every 3 contacts with the FAZ. Obtained in mA data of FVD are transformed into relative values. The obtained data are compared with the norm and it is concluded about the degree of deviation from it and the level of functional health impairment [8]. Mathematical and statistical processing of the results of the observations was carried out using the method of nonparametric statistics proposed by E.A. Derevyanko to determine the magnitude of the shift of the function under the study [9].

**Results and Discussions.** There is quite a lot of data on the effect of the phases of the Moon on the physical and psycho-emotional state of a person. The data obtained by Oleinikova O.M. and others in 2015 on the effects of planetary geomagnetic disturbances show that in a full moon the content of melatonin is lower than that of new moon, regardless of the presence of light. Apparently, other factors of geomagnetic disturbances occurring in the full moon also play a role [10].

Surgery has observed that blood loss during surgery at the beginning of the New Moon was significantly less than at the Full Moon phase that is why the results of interventions and recovery were better, which is explained by the decrease of heart rate and the amplitude at the beginning of the New Moon, that leads to a decrease in arterial pressure. In addition, since

each day the body's strength increases, the wound healing is more intense. In the phase of the Full Moon, the heart works with the maximum force which leads to a great blood loss. However, with each passing day the body weakens and the wound healing slows down [11].

It is known that people have weakness, their mood worsens, adinamia increases, mental capacity and attention decrease, depressive states occur in the young Moon. In the phase of the Full Moon - the person is the strongest, excitability increases, thinking and perception of information as well as memory improves, activity significantly increases, people with unbalanced type of nervous system suffer from irritability, aggressiveness, tendency to affect, conflicts, etc. People suffering from high blood pressure during the full moon phase can have complications: from an increase in blood pressure to heart attacks and strokes and the frequency of myocardial infarction increases up to 11.3%.

It is also known about the effect of the Moon phases on the reproductive function and the peak of ovulation and productive conception in women is during the full Moon phase. The incidence of sudden death from cardiovascular disease is also correlated with the position of the moon. I. Sitar on the basis of the results of 9-year observations (out of 1937 cases of 617 men and 810 women), determined that the first maximum of mortality is 1 - 2 days before the first 1/4 and the second is about 2-3 days before phases of the last 1/4. The first minimum mortality occurs approximately 3 days before the new Moon, and the second one is the day before the new Moon.

The influence of the Moon on the frequency of births, the lethality of the consequences in various diseases, epileptic seizures, mental disorders, suicides and sleep disorders, etc. has been confirmed [1, 3, 11].

In the study of systemic age dependence in the male group of preschool age (PS) 3-6 years, it was found that the change of the Moon phases leads to different changes in the functional activity and homeostasis of the organism (Fig. 1). It is clearly observed that the phased monthly activity indicators of functional systems (FS) double the norm line, varying in amplitude and have the same orientation. Moreover, the presence of significant changes in the studied parameters of activity indicators of FS with the norm line indicates that the maximum differences occurred in the phases of the new and Full Moon. In the New Moon there are maximum deviations in the activity of FS in relation to the functional-age norm and they are characterized by an increase in the activity in the FS of the small intestine (SI), spleen and pancreas (SP), bladder (BL) and gall bladder (GB). There is a decrease in activity indicators in the heart FS (HT), lymphatic system (TE) and stomach (ST) relating to the area of the age functional norm. In the Full moon, there is an increase in the activity in the FS of the lungs

(LU), small intestine (SI), the state of the lymphatic system (TE) and a decrease in functional activity in the FS of the heart (HT), liver (LR), kidney (KI) and gall bladder (GB). In general, a rather chaotic pattern of functional dependencies may be related to the physiological and functional immaturity of adaptation processes and the speed of their formation and stabilization in the body of children 3-6 years old [12]. The rapid rate of morphological and functional development of all organs and systems, the immunity deficiency during this period contribute to the increase of the sensitivity of the children organism to changes in environmental factors, both for ecological, physiological and pathological.

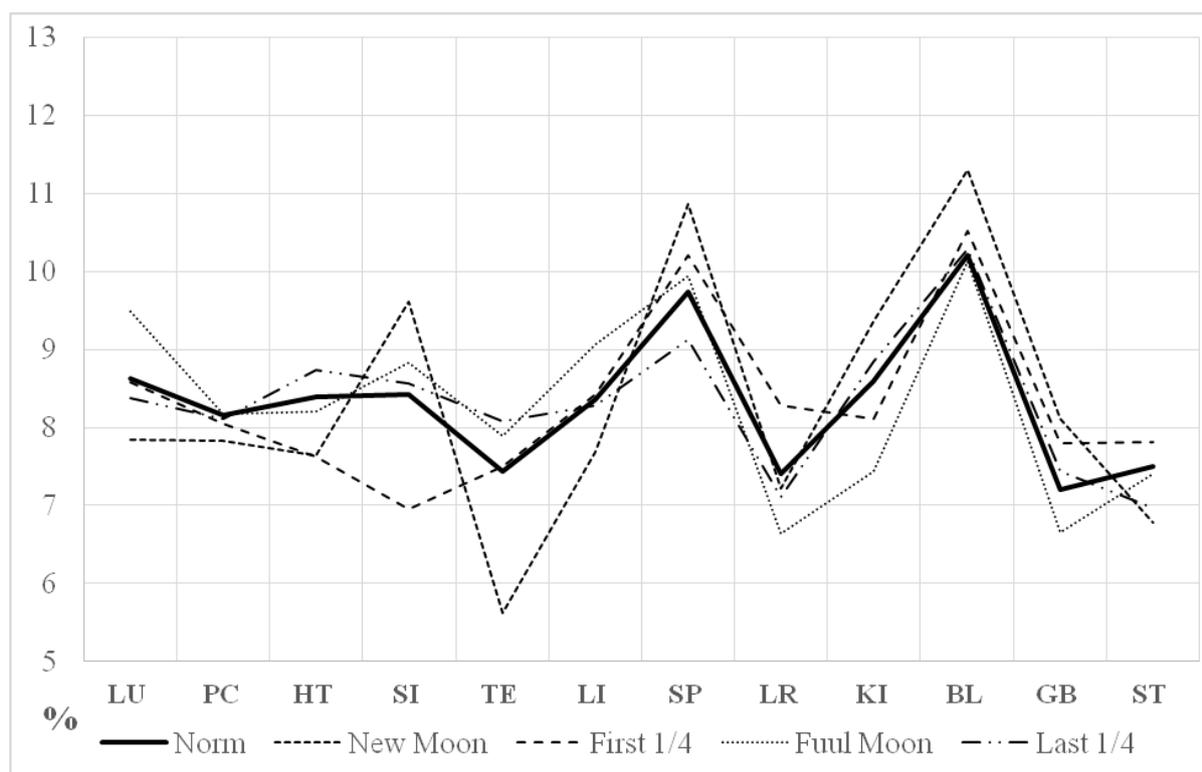


Fig. 1. Systemic age dependence in the male group of 3-6 years old (preschool age (PSA) in different phases of the moon,  $p \leq 0.05$ .

The adolescence is a transition from infant development to the adult stage of ontogeny. The transition process of adolescence captures absolutely all levels of biological organization of the teenager - from changes in the structure of the skeleton, respiratory system, blood circulation to the new reproductive system, its functional and structural support. There is an intensification of the activity of the pituitary gland, intensive physical and physiological development, restructuring of the motor apparatus and neurohumoral relations. It was revealed in the study of systemic age dependence in the male group of 12-15 years

(adolescent school age (ASA) in different phases of the Moon that changing the phases of the Moon on the body leads to changes in functional activity and homeostasis of the body (Fig. 2).

Changes in the activity indicators of FS are observed with much smaller amplitude though the nature and direction of changes in the activity are similar, compared with the male group of 3-6 years old. The analysis of the figure shows the stabilization of adaptation mechanisms in the body of boys in this group of observations.

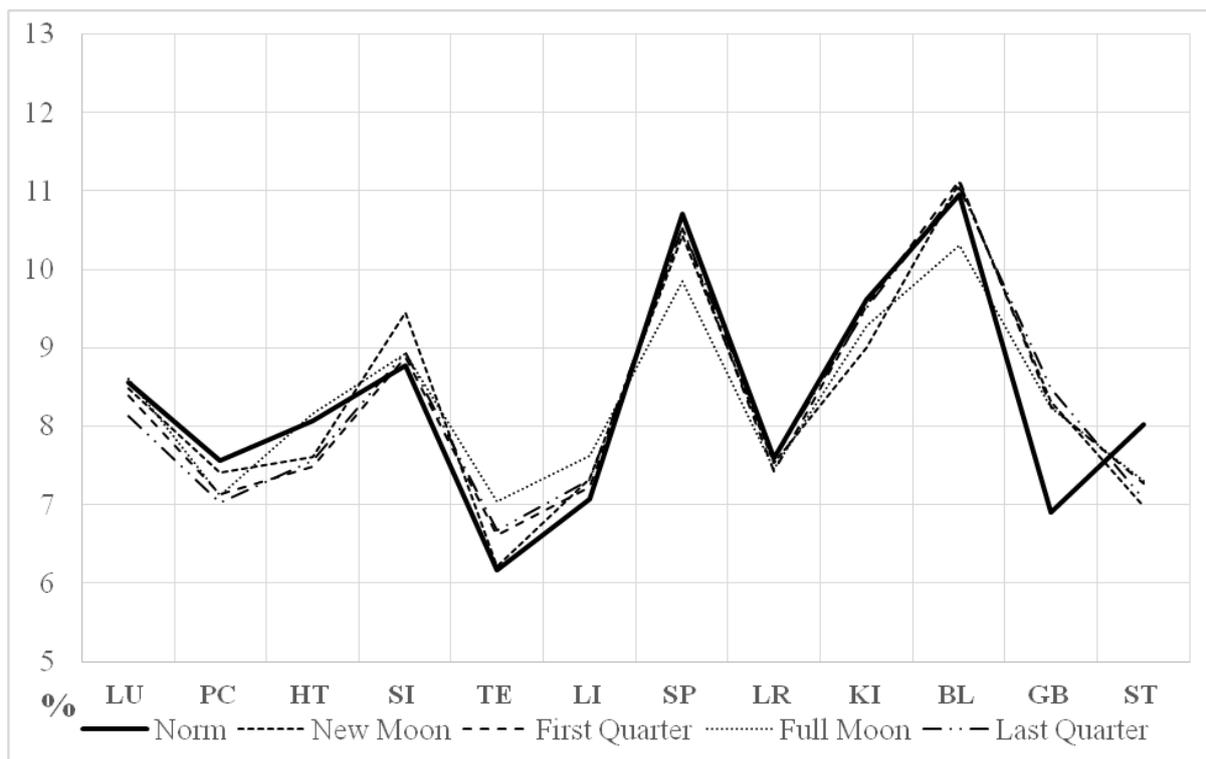


Fig. 2. Systemic age dependence in the male group of 12-15 years old (adolescent school age (ASA) in different phases of the Moon,  $p \leq 0.05$ .

The physiological changes that take place in a person's body with age are, first and foremost, a reduction in biological functions and the ability to adapt to the effects of environmental factors and metabolic stress. At the age of 20, the rate of nerve impulse, renal function, cardiovascular function, muscle strength, healthy volume and lung capacity reach a maximum of 100%. From the age of 30, a gradual decline starts in the level of functioning of the body's physiological systems.

It is worth noting that the impairment of each of the body's functions is uneven. Thus, the vital capacity of the lungs significantly decreases with age (20 years - 100%, 40 years -

74%, 60 years - 50%, 80 years - 25%). And the rate of passage of the nerve impulse of 20 years old is 100%, at the age of 40 it is almost not reduced, at 60 it is 85% and at 80 it is 78%.

Changes in the structure and function of the internal organs and systems of the organism occur during middle adulthood. After 50 years of age, the nervous system slows down. The skeleton loses its flexibility and is shrunk to some extent. The coronary vessels narrow by 1/3 compared to young age and the amount of blood pumped by the heart is reduced by 8% every 10 years of the adult period. The lung volume is also decreasing. Women aged 45 to 51 are usually menopausal. Menopause is accompanied by physical symptoms and intense emotional reactions. In women, after 50 years, bone mass is severely reduced due to estrogen deficiency, which is why bone fractures occur 6-10 times more often than among men. Before menopause women are less likely than men to have cardiovascular disease and after menopause the risk of heart disease increases.

The studies of systemic age dependence in the male group of 21-50 year sold (mature age (MA) in different phases of the Moon showed that the activity of major FS and vegetative homeostasis have a causal relationship with the changes in the phases of the Moon (Fig. 3).

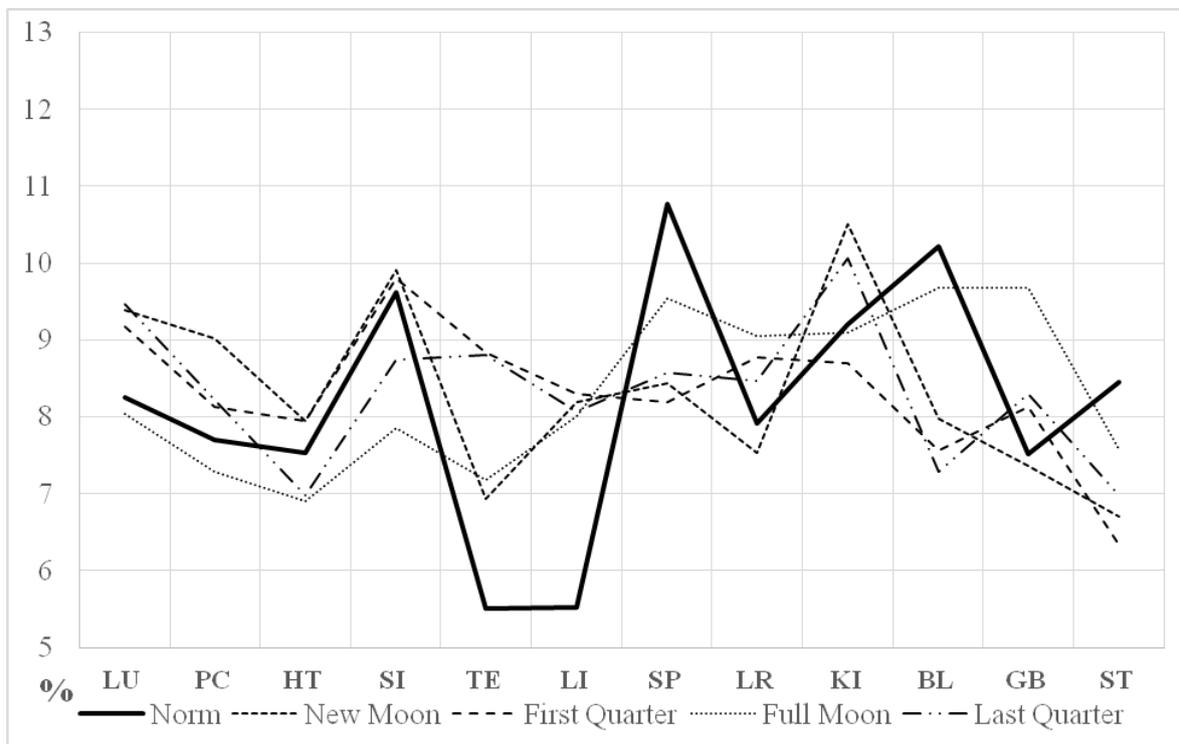


Fig. 3. Systemic age dependence in the male group of 21-50 years old (mature age (MA) in different phases of the Moon,  $p \leq 0.05$ ).

It is possible to identify specific features inherent in men of this age group. In general, in all four phases of the Moon there is no correspondence of indicators of FS activity in relation to the zone of age functional norm. Such manifestations of maladaptation are likely to be associated not only with age-related physiological features but also with the appearance of chronic pathologies in the body. This pattern of changes in the observation group of men of 21-50 years old indicates a decrease in adaptation processes associated with age-related decline in physiological and biochemical processes in the body.

The sympathetic orientation of the autonomic nervous system (ANS) is known to be responsible for the FS of the following: the bladder (BL), the gall bladder (GB), the stomach (ST), the small intestine (SI), the lymphatic system (TE) as well as the large intestine (LI). The parasympathetic orientation of the ANS is responsible for FS of the spleen and pancreas (SP), the liver (LR), the kidney (KI), the lungs (LU), the pericardium (PS), and the heart (HT). The relative ratio of the sum of indicators of total sympathetic activity to parasympathetic activity determines the orientation of the vegetative balance. The numerical result of this correlation is the vegetative coefficient  $kV$  (the autonomic nervous system coefficient), according to which seven levels of functional health dispersion are distinguished today: PAs - the zone of significant parasympathetic activity ( $kV$  to 0.75); PAe is a zone of expressed parasympathetic activity ( $kV$  0.76-0.86); FcP is the zone of functional compensation of parasympathetic activity ( $kV$  0.87-0.94); VE is the zone of permissible vegetative (functional) equilibrium ( $kV$  0.95-1.05); FcS is the zone of functional compensation of sympathetic activity ( $kV$  1.06-1.13); SAe is a zone of expressed sympathetic activity ( $kV$  1.14-1.26) and SAs is a zone of significant sympathetic activity ( $kV > 1.26$ ). It is more convenient to use vegetative dispersion (scattering) across critical zones for functional and ecological assessment of environmental factors, i.e the ratio  $PA (PAs + PAe) - VE (FcP + VE + FcS) - SA (SAe + SAs)$ , which are markers of functional health. It is possible to analyze the impact on humans from the received data on the status of functional health of the population of a certain territory and averaged information on the deviation of the autonomic nervous system, both abiotic factors and possible environmental problems of the territory and its degree of ecological disturbance. As a result of research works it was found out that the main characteristic reflecting the negative influence of factors of external and internal environment is the decrease in the number of people examined in the area of functional equilibrium and their increase in the area of parasympathetic activity. According to the criteria we have developed, functional health of people is in the area of conditional norms while 70% of the population are in the area of vegetative (functional) (VE). An analysis of the

obtained data revealed that no age group of men meets these requirements. This indicates a violation of functional and vegetative health and leads to disadaptation of the organism under the influence of changing conditions of the external and internal environment (Table 1).

Table 1

**Functional health of males of different ages (age standard)**

Age groups	PA (s+e), %	VE (FcP+VE+FCS), %	SA (e+s), %
3-6 years old (PSA)	25,3	55,6	19,1
12-15 years old (ASA)	34,0	53,3	12,8
21-50 years old (MA)	53,8	37,5	8,8

Interesting results were obtained while analyzing the effects of different phases of the Moon on functional health compared to the age range of men of different age groups. The men of the PSA and MA groups are the most sensitive to changes in the phases of the Moon. There is a significant decrease in the number of people in the FE zone and an increase in the PA zone in the group of PS males in the Full Moon and in the second phase, in the group AA it is observed in the new Moon and in the full one as well as in the first and second phases it is increased in all observation groups. The ASA group is influenced by the increase in the number of people in the FE zone and the decrease is in the PA zone (Table 2).

Table 2

**Functional health of males of different ages in the Moon phases**

Moon phases	Critical zones								
	Parasympathetic activity PA (s+e), %			Functional equilibrium (FcP+VE+FcS), %			Sympathetic activity SA (e+s), %		
	PSA	ASA	MA	PSA	ASA	MA	PSA	ASA	MA
New Moon	20,8	25,7	74,9	66,6	59,3	25,1	20,8	14,9	0
First Quarter	23,7	36,2	21,7	67,3	51,9	47,7	9,1	11,9	30,4
Full Moon (Full)	42,3	33,2	47,6	34,6	52,1	23,8	23,0	14,5	28,5
Last Quarter	28,9	39,0	50,0	7,7	50,6	44,5	23,1	10,5	5,6

**Conclusions.** It has been established that the change of phases of the moon on the body leads to significant changes in the functional activity and homeostasis of the body of

men of different age groups. The phase lunar activity indicators of functional systems (FS) line have the same orientation duplicating the norm, differing in amplitude, forming age-specific features of autonomic nervous system (ANS) tone and functional health status in men of different age groups, indicating the same mechanisms of the phase influence of the Moon on the body. The dependence of these indicators indicates a species evolutionary adaptation of the person to changes in lunar activity.

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