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DEPARTMENT OF GENERAL HYGIENE
AND PHYSICAL CULTURE

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SOLAR RADIATION AND ITS BIOLOGICAL EFFECT. USE OF ARTIFICIAL UF IN THE PREVENTIVE PURPOSES

Methodical grant for independent work of students of medical faculties

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Solar radiation and its biological effect. Use of artificial UV in the preventive purposes: methodical grant for independent work of students of medical faculties

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This methodological manual contains material that reflects modern hygienic ideas about the most important factor in the human environment - solar radiation. The data on the types of radiation included in the optical part of the solar spectrum - ultraviolet, visible and infrared, their biogenic and abiogenic effects, symptoms of insufficiency, methods of assessment are presented. Information on the main types of artificial sources of ultraviolet radiation - erythemal, direct mercury quartz and bactericidal lamps, methods of their use, safety measures when working with them is given.

The manual contains a list of questions for self-control, test tasks, a list of basic and recommended additional literature.

Methodical recommendations "Solar radiation and its biological effect. Use of artificial UV in the preventive purposes", prepared in the discipline "Hygiene" in accordance with the Federal State Educational Standard of Higher Professional Education for students studying in the specialty General Medicine (05.31.01).

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Purpose occupations - to acquaint students with biological effect of solar radiation and use of artificial ultraviolet radiation in the preventive purposes.

The student has to know:

a) biological effect of solar radiation;

b) sources of a radiant energy on production and in life, their influence on a human body;

c) main symptoms of manifestation of ultra-violet insufficiency, prevention measure.

d) indications and contraindications to preventive radiation by artificial UF a source;

e) concept "biodose".

The student has to examine:

a) with the device and rules of operation of devices for measurement solar radiation;

b) with the device and rules of operation of devices for measurement of a radiant energy from artificial sources.

c) with calculation of installations for sanitation of air of rooms artificial sources of short-wave UF of radiation – germicidal lamps from a cathedral glass;

d) with calculation of installations of preventive radiation of people artificial sources of long-wave UF of radiation.

The student has to be able:

a) to measure intensity of UF of radiation;

b) to define a biodose;

c) to give an assessment of effect of disinfecting of air by means of bactericidal ultraviolet rays.

Content of training

Solar radiation – the integral flow of electromagnetic oscillations and corpuscular particles including X-ray beams, scale beams, light (visible), infrared (thermal) and ultraviolet rays, and also radio waves.

Components of sunlight are:

- direct (proceeds directly from the sun);
- disseminated (from the heavenly arch);
- reflection (from a surface of various objects).

The atmosphere passes to the Earth's surface only an optical part of a range which enter invisible ultra-violet (290-400 nanometers), visible light (400-760 nanometers) and invisible infrared beams (760-2800 nanometers). At the Earth's surface an ultra-violet part makes 1%, seen – 40%, infrared – 59%.

Solar radiation exerts impact on a metabolism in an organism, its tone and working capacity, is a powerful recreational and preventive natural factor. In addition to thermal effect and influence on functions of an organ of sight it has diverse biological effect on all organism.

The factors determining tension solar radiation:

1. Condition of weather (cloud, draft, etc.);
2. Extent of pollution of atmospheric air;
3. Height of standing of a column (mass of air);
4. The latitude of the area (defines a hade of sunshine (the closer to the equator, the less scattered solar radiation);
5. Time of day, years.

The greatest value for hygienic assessment of external environment has **optical spectrum** - infrared, visible and ultraviolet rays.

Infrared radiation (760-2800 nanometers)

Influences molecules and atoms of various substances, causing thermal effect. Exerts a direct impact on climatic and weather conditions and mediated – not life activity of plants and animals, a state and health of the person. Gets through the atmosphere, thickness of water and the soil, through a windowpane, clothes.

Short waves (760-1400 nanometers) have big energy, big penetration. Can get into deep layers of skin, without causing caumesthesias. Get through tissues of the person including skull bones, on depth 4-5 cm. At impact on brain receptors

perhaps erythematic inflammation. Under the influence of short-wave IK of radiation temperature of fabrics increases that can lead to heatstroke emergence. Changes from cardiovascular system – tachycardia, increase systolic and decrease in diastolic pressure. Infrared radiation of the Sun promotes development of a cataract. Impact on lens is possible also under production conditions (a professional cataract).

Long waves (1400-2800 nanometers) are absorbed by skin blankets, cause a burning sensation. Promote blood circulation improvement, weaken conditioned-reflex reaction of vessels.

At local action on IK fabric radiation accelerates biochemical reactions, enzymatic and immunobiological processes, growth of cells and an angenesis, strengthens biological effect of ultraviolet rays.

The positive systemic effect is shown in the form of normalization of a tone of the autonomic nervous system, soothing, antivospalitelny action. These IK properties of radiation use in physical therapy by means of artificial sources.

Methods of measurement of solar radiation

The Aktinometrichesky devices intended for definition of scattered and total solar radiation are called piranometra.

Naiboly is biological – *ultra-violet radiation*, is a permanent environmental factor.

On the nature of biological effect an ultra-violet part of a range conditionally divide into three areas – And, In, Page. Long-wave area A (320-400 nanometers) the mediumwave area B (280-320 nanometers) – vitamin forming action has preferential zagarny action,. The area C (200-280 nanometers) has preferential bactericidal action which cornerstone disturbance of life activity of microbic cells is.

Absence or long lack of impact of ultraviolet radiation on an organism negatively influences human health and can lead to development of morbid condition – ultra-violet insufficiency or light starvation. The people working in the subway, mines, underground mines, living in the north have deficiency of

ultraviolet rays. At cloudy weather intensity of ultra-violet radiation at the Earth's surface can decrease to 80%, at air pollution by dust aerosols for 11-50%.

Ultra-violet insufficiency negatively is reflected on health and is shown by decrease in adaptation opportunities of an organism, oxidation-reduction processes, deterioration in an angenesis, disturbance of phosphorus-calcium exchange, firmness of capillaries, defeat of a nervous system, system of a hemopoiesis, parenchymatous bodies, increase in fatigue, decrease in working capacity and body resistance to toxic, cancerogenic, mutagenic and infectious agents. Hasty manifestation of ultra-violet insufficiency is hypovitaminosis or avitaminosis D. At adults disturbance of phosphorus-calcium exchange is shown in bad accretion of bones at changes, weakening of the copular device of joints, in bystry destruction of enamel of teeth. Ultra-violet insufficiency at children in the conditions of normal food is a major factor of exogenous rickets.

Artificial ultra-violet radiation is applied to compensation of a lack of a sunlight.

Contraindications for radiation of the person artificial UF radiation are diseases of an active form of tuberculosis, a thyroid gland, sharply expressed atherosclerosis, diseases of cardiovascular system, a liver, kidneys, malaria, malignant new growths.

For prevention of ultra-violet starvation radiation by artificial sources of ultraviolet radiation in fotariya, and also enrichment of a light flow of sources of artificial lighting is recommended.

Excessive use of ultraviolet rays of both a natural, and artificial origin, negatively is reflected in a condition of an organism: eyes (photo or an elektroftalmiya), skin (an erythema, a photosensitization, a carcinoma cutaneum) are surprised.

Abiogenous action of UF of radiation. At increase in a total visual dose there is DNA synthesis oppression, CNS function braking, a hypertrophy of cells of adrenal glands, disturbance of exchange of vitamins, a leukocytosis, strengthening of a carcinogenesis. It is shown in the form of burns, a photodermatosis, tumors,

phototoxicosis, a photoallergy, a keratoconjunctivitis, a photokeratitis, a cataract, etc.

Now in connection with change of an ozone layer of the atmosphere danger of an ultra-violet carcinogenesis increases.

Units of intensity of UF of radiation

Measurement of intensity of ultra-violet radiation is performed in biodoses. The BIODOSE – the size of an erythematous flow causing an erythema in 6-10 hours after radiation. Power unit is expressed in milligram-calories on 1 cm^2 in a minute.

Methods of measurement of ultra-violet radiation

There are two methods of measurement of intensity of ultraviolet radiation: photochemical and photo-electric.

Photo-electric metod of measurement of ultraviolet radiation is based on transformation of a radiation energy to electric current.

The devices intended for definition of intensity of UF-radiation on-ultrafioletmetram zyvatsya. (UFMULTRAFIOLETMETR (UFM-51) is intended for definition of a radiation intensity in microwatts on cm^2 and for definition of an exposure dose in micro watts on cm^2 in a second.

Andzucheniye of bactericidal action of ultra-violet radiation

The most economic and convenient way of disinfecting of objects of external environment is use of lamps of BUV (germicidal lamps from a cathedral glass). Lamps of BUV are area C Uv-radiation sources. They are applied only to disinfecting of objects of external environment: air, water, objects (ware, toys), foodstuff, medicines.

There are two methods of sanitation of air of rooms BUV lamps: in the presence of people in the room and in their absence.

Artificial sources of UF of radiation

Put three types of artificial sources of ultraviolet radiation into practice.

1. Erythematous luminescent lamps (LE, EUV) – sources of ultraviolet radiation of area A and B. A lamp radiation maximum – area B (313 nanometers). Lamps of EUV release power 15 W (EUV-15) and 30 W (EUV-30).

2. Direct mercury-quartz lamps (PRK) are powerful sources of radiation in ultra-violet areas A, B, C and a visible part of a range.

The maximum of radiation of a lamp of PRK is in areas B (25% of all radiation) and With (15% of Sundayits radiations). Lampa of PRK apply to radiation of people preventive and medical doses, for disinfectings of objects of external environment (air, water, etc.).

Пlamps of PRK of three types are applied: PRK-2 (375 W), PRK-4 (220 W), PRK-7 (1000 W).

3. Germicidal lamps from a cathedral glass (BUV) are area C radiation UF sources. They are applied only to disinfecting of objects of external environment: air, water, objects (ware, toys).

Make the 15 W lamp (BUV-15), 30 W (BUV-30), 60 W (BUV-60) and 30 W with the increased density of current (BUV-30P). The special shielding equipment directing beams so that the included lamp was not visible to the standing person is developed for lamps of BUV.

Use of artificial long-wave UF of radiation for radiation of people.

Svetoobluchatelny installations. There are two types of irradiating installations: long and short-term action.

The first method of radiation consists that usual (or improved) artificial lighting indoors is sated with ultraviolet rays by means of radiation UF sources. All people who are in the room are irradiated during the whole time of stay of UF in it with a flow of small intensity (svetoobluchatelny installations).

Eritemnae svetoobluchatelnae установкand use: in child care facilities, treatment and prevention facilities, houses (hostels), gyms, in production rooms without natural light. Duration of work of installation depends on light climate: for northern areas – from October 1 to April 1; for averages – from December 1 to April 1. People are in rooms in usual clothes, open are a face, a neck and hands.

Irradiators establish on a ceiling or a wall, at the level 2,5 m from a floor. Duration of radiation depends on usage time of this room (in classes of schools of 4-6 hours, in kindergartens of 6-8 hours, etc.).

QUESTIONS FOR CHECK OF LEVEL OF KNOWLEDGE:

1. What structure of a solar range.
2. Biological effect of infrared radiation of the sun.
3. What biological role of the UF separate areas of radiation.
4. State the reasons (natural and artificial) emergence of UF of insufficiency.
5. The main symptoms of manifestation of ultra-violet insufficiency (starvation) at adults and children and a measure of prevention.
6. What persons of professions most sharply test the insufficiency UF phenomenon.
7. Give the short characteristic of artificial sources of UF of radiation.
8. The positive shifts which are observed in an organism under the influence of artificial UF of radiation.
9. Photo-electric method of measurement of UF of radiation, the used devices, their structure and the principle of work.
10. List indications and contraindications to radiation of people.
11. What rules of definition of a biodose at the organization of radiation of people?
12. What is a photo-ophthalmia? Call its symptoms.
13. Characterize irradiating installations (long and short-term action).
14. As assessment of bactericidal action of UF of radiation is carried out.
15. How control efficiency of sanitation of air in MPI?
16. List actions for elimination of changes in air at short-wave UF radiation?