



Hygiene description of climate and weather of hot and tropical breadths (features of sun radiation, daily allowance and seasonal vibrations of parameters of microclimate). Features of influence of tropical climate on the terms of life, capacity and health of population. Features of planning and building and sanitary equipping with modern amenities of the populated places in the conditions of tropical climate. Hygiene, toxicological and epidemiological problems of feed of population of tropical regions. Hygiene of water and feature of water-supply of population in the conditions of tropical climate.

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HYGIENIC CHARACTERISTIC OF TROPIC CLIMATE

TROPICS:

Equatorial zone from 10 north latitude till 10 south latitude

Tropical climate zone from 10 till 20 north latitude and from 10 till 20 south latitude

Subtropical climate zone from 20 till 30 north latitude and from 20 till 30 south latitude

The most of the land belongs to tropics: almost all Africa, South Asia, south of East Asia, the most part of Latin America, Oceania.

Transitional zone adjoins to tropic zone (Mediterranean area, front and middle Asia, the south of the USA etc.) and it is characterized as tropic and mild zones from to medico-geographical point of view.

Climate classification for tropic countries:

- 1. Steppe climate;
- 2. Mediterranean climate;
- 3. Savannah climate;
- 4. Subtropical and tropical desert climate;
- 5. Humid tropical forest climate.

STEPPE CLIMATE

There are two steppe categories:

Steppes, which are situated in mild latitudes

Steppes which are situated in tropic and subtropical latitudes along the desert periphery.

There are frequent hot air temperatures ($30-40^{\circ}$) with low humidity in summer.

Average temperature of the warmest month is $+24^{\circ}\text{C}$ (in steppe of mild latitudes), in steppes of tropical latitude it is $4-6^{\circ}$ degrees more.

In winter it is warm without frost and snow in tropic zone steppes.

It is snowy and temperature decreases to -10° -20° in mild latitudes steppes.

MEDITERRANEAN CLIMATE

Average temperature of the coldest month is 0°C , the warmest month temperature is $+22$ to $+28^{\circ}\text{C}$.

The summer is hot and dry, sometimes the temperature reaches $+42$ to $+45^{\circ}\text{C}$ due to hot winds (sirocco and mistral) from the North Africa deserts.

SAVANNAH CLIMATE

Savannahs are widely spread in the most part of Africa and South America tropical part, in Hindustan from 22 south latitude, on the Ceylon island, Myanmar central part, Indo-China, Australia north part, Hawaii.

Savannah is tropical forest–steppe. Grass covering develops here at the beginning of rain periods. There are trees (evergreen and trees which drop their leaves in dry season) but they don't form big areas.

In winter dry continental tropical air prevails, brought by trade winds, in summer there is wet air from equator.

That is why wet weather with heavy precipitations is frequent in summer, the highest average temperature per month is $+25...+30^{\circ}\text{C}$.

But in winter the weather is dry, the lowest average month temperature is $+15.....+18^{\circ}\text{C}$.

SUBTROPICAL AND TROPICAL DESERTS CLIMATE

The tropical desert is an environment of extremes. This extremity causes people's life impossible because of dry sunny and hot weather prevalence.

Average summer month temperature increases to $+25...+30^{\circ}\text{C}$ and day temperature in shadow may reach $+40...+50^{\circ}\text{C}$.

There are deserts of Sahara, Libyan, Nubian, Namibia, Kalahari and also Arabia, South America and central part of Australia deserts.

Common characteristic for deserts:
Complete absence of cloudiness
High solar radiation amount
High air and ground temperature
Dryness and high level of evaporation
Limited or complete absence of water resources

Average annual air temperature is higher than $+18^{\circ}\text{C}$, in some places it reaches $+25^{\circ}\text{C}$ and more.

In summer average month air temperature reaches $+28...+37.5^{\circ}\text{C}$ and it is $+32^{\circ}\text{C}..+36.5^{\circ}\text{C}$ common in the warmest place but it can reach $+40^{\circ}\text{C}$.

Day temperature often reaches +40...+45⁰C or even +50⁰C (Sahara, Death Valley). Maximum average month air temperature was +49⁰C and absolute maximum air temperature in shadow was +55...+63⁰C (Somali, Africa).

During the day ground temperature may increase up to +80⁰C and at night under conditions of clear sky air and ground temperature decreases to +10....+1⁰C.

In winter average month air temperature is approximately +10⁰C.

TROPICAL RAINFOREST CLIMATE

Tropical rainforest climate is spread in Equatorial Africa, South America, Central America, west coast of Indo-China, south-west coast of India, Malaccan peninsula, Philippines, New Guinea and others. It is widely spread along the Congo and the Amazon rivers.

Climate is hot and humid.

Average annual air temperature is high ($+24^{\circ}\text{C} \dots +29^{\circ}\text{C}$). Important peculiarity is that average month air temperature is monotonous with little difference between the warmest ($+27 \dots +28^{\circ}\text{C}$) and the coldest ($+24 \dots 25^{\circ}\text{C}$) months.

Air humidity is 70-80-% and more. Under high radiant temperatures and little air movement in tropical rainforests the organism heat exchange is under great physiologic tension.

Thermoregulation - the complex process, consisting from heat-formation (chemical thermoregulation) and heat-return (physical thermoregulation).

Heat-formation is provided due to biochemical exchange processes (so, at easy work in organism of the person it is formed about 3000 Kcal heat for day). In hot climate organism receives from environment additional amount of heat (up to 200-400 Kcal / hour).

The level heat-formation in organism basically depends on temperature of air; the zone of indifference is 15-25⁰C, at higher temperature heat-formation is reduced.

Heat-return consists of conducting:

- Heat to air (convection)
- Conduction
- Thermal radiation IR-beams
- Evaporation sweat

INFLUENCE OF A HOT CLIMATE ON THE SYSTEM OF THE THERMOREGULATION ORGANISM

Infringements thermoregulation:

- Heatstroke
- Thermal spasmes
- Thermal faint
- Thermal exhaustion by water and salt losses
- Thermal hypostasis of foot

THE FACTORS CONDUCTING TO OVERHEATING OF ORGANISM

- High temperature and humidity of air, small speed air movement;
- Heavy muscular work - increases heat-production;
- Multilayer clothes;
- Insufficient water inflow in organism - is worsened ewaporation of sweat.

Forms of heatstroke:

I. Depending on prevalence of those or other symptoms

- 1) Cardio-vascular
- 2) Pulmonary (atelectasis)
- 3) Brain
- 4) Shock
- 5) Delirious

II. On degree

- 1) Easy
- 2) Average
- 3) Heavy

INFLUENCE HOT CLIMATE ON A WATER AND MINERAL EXCHANGE

At usual temperature about 20°C water is allocated through kidneys, skin, lungs and intestines in the ratio 6 : 2 : 2 : 1.

At high temperature of air water basically (up to 70-80 %) is allocated through a skin as sweat. Loss of water with it at temperature $37,8^{\circ}\text{C}$ makes 0,3 l / hour and with rise temperature by everyone $0,5^{\circ}\text{C}$ is increased on 20 ml.

In hot climate at weakened people at heavy physical work daily losses of water can reach 12 liters - thus can give dehydration of the organism different degree of weight. Thus plasma of blood first of all suffers.

Thus viscosity of blood, the contents of hemoglobin sharply raises, the volume of circulating blood decrease - reduction speed of blood circulation, reduction shock volume of heart, increase frequency of cardiac reductions.

DEHYDRATION EXHAUSTION

- **loss water up to 5 %** from weight of a body there are feelings of indisposition, drowsiness, irritability;
- **at 6-10 %** - dizziness, headache, termination salivation, dysarthria;
- **more than 10 %** - infringements of sight, hearing, speech, unconsciousness, delirium.
- **at loss water 11-20%** from weight of a body causes difficulties in swallowing, delirium, deafness, sight insufficiency, painful urination, anuria, swollen tongue, numb skin.
- **at loss water 15 %** from weight of a body at temperature above 30°C there can come death

Lack water in organism is accompanied by subjective feeling of thirst; distinguish true (at dehydrotation organism) and conditioned-reflex thirst (at absence deficiency of water in organism).

In hot climate at weakened people at heavy physical work the original condition of water famine can arise: the more the person drinks, the more he would like water. If such condition to not remove, there can come a heavy stage - DRINKING ILLNESS or the WATER INTOXICATION.

SYMPTOMS OF THE WATER INTOXICATION

- Salivation
- Nausea
- Vomitting
- Strengthening urine formation
- Frustration coordination movements.

CHANGES SALT EXCHANGE IN CONDITIONS OF A HOT CLIMATE.

Special value here has infringement exchange natrium chloride (NaCl) . At small sweat evaporation from total NaCl lost by organism per day (15-20g) with sweat is lost 2-6 g/day.

Compensation reactions organism for prevention salt deficiency:

- decrease the contents chlorides in sweat up to 0,1 % (norm sweat contains 0,3-0,6 % NaCl)
- decrease diuresis up to minimum (360-400ml/day).

SALT EXHAUSTION

- strong gastric spasms
- vomiting
- apathy
- faints
- possible spasms (increase excitability muscles at decrease chlorides in plasma).

For treatment it is required additional introduction NaCL.

In conditions of a hot climate some restriction of water consumption is necessary. For example, at work at $+39-40^{\circ}\text{C}$ for person it is necessary 6 l / day by fractional reception of water - 100-150 ml for 1 time.

HYGIENIC AND EPIDEMIOLOGICAL SIGNIFICANCE OF WATER IN TROPICAL CONDITIONS

Hygienic demands in water in tropical climate are also much higher. Water supply norms must reach 150-500 l per day. Apart from food and drinking demands, water is necessary to relieve the heat stress, body care, skin breathing, organism tempering (frequent bathing, dousing with water).

Water is necessary for sanitary and domestic needs (laundry, cleaning of premises, sewerage system maintenance), for industrial needs, recreational needs (irrigation of trees, streets, fountains etc., for comfortable rest area creation).

PECULIARITIES ENDEMIC AND EPIDEMIC WATERBORNE DISEASES OF ARID TROPICAL AREAS

Arid tropics water resources are characterized by high mineralization – 3000-5000 mg/l salts. Due to intensive water evaporation concentrations of Ca, Mg, Na, K, Fe, HCO_3^- , Cl^- , SO_4^{2-} , NO_3^- are much higher, water is of bitter-salt taste, appearance of dyspepsia, children suffer from water-nitrate methemoglobinemia (blue baby syndrome).

High water hardness – more than 7 and sometimes even 14 mg-equiv/l can cause diarrhea (weakened Mg action), renal calculi (of Ca).

Disadvantages of hard water usage for domestic purposes

Meat and beans are badly boiled

There are insoluble Ca and Mg soaps in washing which impregnate tissue pores decreasing their ventilating and evaporating ability, promote scale on the dishes, technical steam boilers etc.

**This water is characterized by high contents of
microelements:**

**-fluorine -molybdenum - arsenic - cadmium
- chromium**

Nitrates and other agrochemicals (which are widely used in tropical areas) enrichment of surface water promotes water mineralization (higher water salinity) which has negative influence on population health: pesticides accumulate in water reservoir organisms – fishes, mollusks and other organisms which are used in population nutrition.

PECULIARITIES ENDEMIC AND EPIDEMIC WATERBORNE DISEASES OF HUMID TROPICAL AREAS

On the contrary, in humid tropics, due to high rainfalls water resources are little mineralized that causes teeth caries (fluorine is less 0.5 mg/l), endemic goiter (guiros endemia) etc.

Soft water causes cardio-vascular diseases, sudden death of myocardial infarction: significant lack of Ca, Mg, K has negative influence on heart activity.

WATERBORNE INFECTIOUS DISEASES THE LEADING FOR THE TROPICAL REGIO

1. typhoid
- 2.A and B paratyphoid fever
- 3.cholera
- 4.bacterial and amebic dysentery.

In 1956 in India 99 300 people suffered from viral hepatitis A, in 1986 1 200 people were ill with el-Tor cholera.

THERE ARE WIDE SPREAD:

- salmonellas
- shigella
- rotaviruses
- pathogenic bacillus strains
- campilobacter

- enterokolitics
- newborn diarrhea viruses
- poliomyelitis
- epidemic infectious conjunctivitis
- trachoma

**THERE ARE WIDE SPREAD
ZOOONOSIS INFECTIONS SUCH
AS:**

leptospirosis
brucellosis
Tularemia
Q-fever

HELMINTH INVASION IS SPREAD AMONG THE POPULATION:

- lambliasis
- ascariasis
- trichocephaliasis
- ankylostomidiasis
- fascioliasis
- drancunculosis
- diphyllbothriasis
- opisthorchiasis
- angiostrongylidosis
- clonorchiasis

HYGIENIC REQUIREMENTS TO WATER QUALITY AND THEIR PECULIARITIES IN TROPIC CONDITIONS

- good organoleptic properties: to be transparent, colourness, without suspended materials inclusions which left on the surface, odours, after-taste, to have pleasant fresh taste (which depends on water temperature, dissolved salts and gases);
- to have optimal salt composition;
- not to have poisonous substances in toxic concentrations;
- not to have infectious agents and other organisms.

For developing countries and others, WHO has developed International Water Standard (IWS – 73) which is used as it is or serves as the base for the national standards development considering local conditions.

Limited permissible concentration of harmful substances in IWS – 73 is counted for the consumption of 3 liters per day. That is why local limited permissible concentrations such harmful substances of tropical region should decrease proportionally to water consumption amount in this locality.

HYGIENIC CHARACTERISTIC OF WATER RESOURCES AND SOURCES OF WATER SUPPLY IN TROPICAL REGIONS

There is no water problem in humid tropics: area is covered by forests, jungle, frequent heavy rains, tropical storms constantly replenish surface and underground waters.

There is significant water deficiency in arid areas especially in deserts, seasonal water changes into drought or rain absence create hard living conditions for living organisms or make life impossible.

There is a tradition of rain water collection in rain periods and its preserving in a drought period. Such water is weakly mineralized (to 30-50 mg/l) and contains dust pollution, trees leaves, bird excrements.

Water is preserved in barrels or dug into the ground concrete or clay tanks which are supplied with ventilating canals to prevent water decay. Water is taken from such tanks using pumps with hose or tube with a tap set 15-20 cm above the bottom. There is tube for sedimentation which is placed on the bottom level and aimed to let the water out.

This water can be preserved there only for a short time because water filtrates into the soil, evaporates, loses its qualities, and thus is not used for drinking but only for domestic purposes.

Open water reservoirs (rivers, streams, lakes) are easily and heavily polluted and become source of infections, invasions, zoonosis, fungi, because of intensive water evaporation, water is highly mineralized.

Ground, subterranean and artesian water in arid regions are usually located deep under the ground, are highly mineralized, clear and are not dangerous epidemically. But there is not enough of such water in arid areas.

Ground water – subterranean and artesian – doesn't need purification and disinfection. In some cases softening, desalination and defluorination are necessary.

Depending on size and pollution degree, surface water is able to self-purify because of suspected materials inclusion sedimentation, solar radiation, aeration (organic substances oxidation), dilution, biochemical oxidation, saprophytic microorganisms, bakteriofages action, nitri- and nitrofication.

But reproduction of pathogenic organisms, viruses, infectious agents is possible in hot regions. In case of significant pollution water can decay and become unusable for domestic and drinking purposes.

WATER PURIFICATION AND DISINFECTION METHODS IN TROPICAL CONDITIONS

In case of centralized water supply water from open reservoirs should be purified at water pumping stations: by means of ware precipitation and filtration through slow english type filtrates (with biological film) and stabilization at small stations; at big ones, water should be purified by means of coagulation, desilting and filtration trough quick american filters.

The most widely used method is:

1. chlorination

- according to chlorine requirement;
- over chlorination;
- double chlorination;
- with pre-ammonization;
- with using of gas-like chlorine;
- chlorine lime;
- calcium hypochloride;

2. ozone-treatment

3. ultraviolet radiation

In case of decentralized water supply, water purification from open sources can be achieved only by desilting of water.

The most simple and reliable disinfection method is boiling, but it only allows disinfection of small water volumes and it can be impossible in deserts because of fuel absence.

The most used chemical method for disinfections is “Halazone” tablets with chloramines, “Chlordechlor” with more chlorine concentration and hyposulfite sodium which is released from soluble plastic capsule after chlorine exposure, then water is dechlorinated. If water is very suspicious, 2-3 tablets are used. “Aquacide” and “Aquaceptol” with 4 mg of active chlorine per 1 l of water are used in our country.

Portable bacteriological filters are used in many tropical countries, where water is filtrated through changeable ceramic fine pore filters - so called Berkfeld – Shamberlen candles which are set in vessel. Water is filtrated under the pressure from the hand pumping or joining to pumping tap.

HYGIENE OF NUTRITION IN CONDITIONS OF THE HOT CLIMATE.

Conditions of rational nutrition are the following:

- quality value of dietary intake, which means presence of all substances in necessary amount and their balance;
- energetic value of food intake. It means correspondence to organism energy expenditure, including undigested part of food (in middle climate this part is 10%, in tropical climate it is considerably more);

- rational diet. It means correspondence of food intake to biological rhythms (food intakes in certain time of the day). Also the certain number of food intakes, intervals between them, balance between the values of different food intakes during the day;
- enzymatic constellation. It means correspondence of food products quality to enzyme ability of individual digestive system (quality of culinary processing, condition of food intake, spices, and other factors, that make the food easy for digestion and assimilation).
- epidemiological and toxicological food safety which means the absence of infectious organisms, helminthes and poisoning substances in toxic concentrations;

FEATURES OF NUTRITION IN A HOT CLIMATE.

At long action high temperature and humidity of air decrease the basic exchange to 10 % as a result influence of heat on vegetative nervous system. There can be decrease appetite, salivation, gastric secretion and motility is especially to meat food.

In a diet of the population of some regions with a hot climate (Africa, Southeast Asia, South America) is marked significant deficiency of proteins animal origin with prevalence vegetable carbohydrates (carbohydrate monofagism). It is connected to a low level of material maintenance of the population, religious and traditional factors. The contents in food much cellulose conducts to constant mechanical irritation of intestines, especially thick, and to development colitis. High temperature and many carbohydrates in food promote activization fermentative processes in intestines, especially in children – may be toxic dyspepsia.

Unilateral carbohydrates feed at lack of irreplaceable amino acids, animal fats and some vitamins results in occurrence specific diseases:

Kvashiorcor (in translation - "the red boy"). Heavy disease children after their excommunication from female milk and translation into a carbohydrate feed (lack of animal protein, methionin, fat-soluble vitamins): inhibition growth, backlog in weight, hypostases, dermatosis and depigmentation skin, backlog of intellectual development, fatty infiltration liver, atrophy of a pancreas, hypoxromic anemia.

Spru - heavy chronic disease - the persistent diarrhea, gastritis, anemia, atrophy mucous of stomach and intestines, violations in bone brain and liver, gradually develops general cahexya (big loss masses of body).

PREVENTION ALIMENTARY DISEASES IN A HOT CLIMATE.

Basis of it is observance principles of a balanced diet, especially equation of a feed on proteins, fats, carbohydrates, mineral substances and vitamins. Maintenance proteins full value is very important - processes of biosynthesis depend on it. It is necessary use animal fats - 60-70 % from total amount. In feeding it is necessary liquidation carbohydrate monofagism, raised receipt of vitamins C, B1, B2, B6, PP etc.

Features of a diet: reception food in more cool time of day - up to 40-50 % of a daily diet in the morning or in the evening.

HYGIENE of WORK IN CONDITIONS of the HOT CLIMATE

Primary goal is the prevention overheating and infringements water-salt exchange. For this purpose work should be carried out in more cool periods of day - earlier begin work, having rummaged from 12 o'clock till 18 o'clock. In an operating time are necessary often breaks (10-15 minutes each hour) with rest in a cool place and acceptance water. For prevention strengthening toxic influence professional harmful factors in conditions of heat climate the important value has automatization, hermetic sealing, ventilation at manufacture, mechanization heavy physical work.

Requirements to working clothes:

- not multilayered
- from easy natural materials
- light colouring
- free breed

At work on open deserted district the clothes as much as possible should protect all parts of a body from action of direct solar beams and dust, for protection eyes - smoky glasses.

PERSONAL HYGIENE IN CONDITIONS of the HOT CLIMATE

It is necessary early morning rise, often acceptance soul (prevention overcooling) and washing clothes (the polluted clothes worsen heat exchange), cleanliness of a body (the high temperature and humidity of air promote occurrence dermatitis, cracks of a skin), employment physical culture and sports at cool o'clock, sufficient night and day time dream.

HYGIENE OF LIVING ROOMS In the HOT CLIMATE

The basic purpose - protection rooms from overheating. Optimum parameters of microclimate in premises in conditions of a hot climate (at temperature of air outside 30°C and higher) must be: temperature $24-25^{\circ}\text{C}$, humidity 45-55 %, speed movement of air 0,1-0,2 m/s. At temperature of environment more than 35°C to achieve such parameters only by aeration (airing) it is impossible - it is necessary application air conditioning of premises (rooms).

The complex building and sun-protection measures is necessary: apartment houses are better for building near to green plantings and reservoirs, orientation of windows - to the north, building materials should be heatproof: tree, brick, foam concrete, pise-walled materials. Building with an attic with good isolation and aeration is necessary. It is expedient to increase the sizes of rooms and their height. Colouring of external walls is recommended light for reflection of solar radiation; special canopies, a venetian blind above windows.

Thanks for attention