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# ТИББИЁТДА ЯНГИ КУН
# НОВЫЙ ДЕНЬ В МЕДИЦИНЕ
# NEW DAY IN MEDICINE

***Илмий-рефератив, маънавий-маърифий журнал***
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# DEPENDENCE OF HUMAN PHYSIOLOGICAL CONDITION ON BIOPHYSICAL PARAMETERS

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✓ ***Resume***

***All human intellectual activity is based solely on the consumption of energy. Without energy, it is impossible to imagine the activity of the organism, the normal functioning of all the necessary benefits for people. This factor is extremely important both within a person and for his existence in the environment. Various areas of production cannot work independently, because they require constant energy production. Living systems for their existence must constantly replenish and expend energy. Energy processes in ecosystems obey the first and second laws of thermodynamics. In accordance with them, energy does not arise and does not disappear, it only passes from one form to another (the first law of thermodynamics is the law of conservation of energy). Some of the energy is dissipated in the form of heat.***

***The dependence of the human physiological state on biophysical parameters, the application, importance and changes of thermodynamic indicators in the human body are explained.***

***Key words: Thermodynamic indicators, thermoregulation, energy balance, heat transfer, heat war, application of the first and second laws of thermodynamics to the human body.***

# ЗАВИСИМОСТЬ ФИЗИОЛОГИЧЕСКОГО СОСТОЯНИЯ ЧЕЛОВЕКА ОТ БИОФИЗИЧЕСКИХ ПАРАМЕТРОВ

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✓ ***Резюме***

***Вся интеллектуальная деятельность человека основывается исключительно на потреблении энергии. Без энергии невозможно представить себе активность организма, нормальное функционирование всех необходимых благ для людей. Данный фактор крайне важен как внутри человека, так и для его существование в окружающий среде. Различные сферы производства не могут самостоятельно работать, ведь они требуют постоянного получения энергии. Живые системы для своего существования должны постоянно пополнять и расходовать энергию.***

***Энергетические процессы в экосистемах подчиняются первому и второму законам термодинамики. В соответствии с ними, энергия не возникает и не исчезает, она лишь переходит из одной формы в другую (первый закон термодинамики — закон сохранения энергии). При этом часть энергии рассеивается в виде тепла.***

***В данном статье объясняется зависимость физиологического состояния человека от биофизических параметров, применение, значение и изменение термодинамических показателей в организме человека.***

# INSON FIZIOLOGIK HOLATINING BIOFIZIK PARAMETRLARGA BOG‘LIQLIGI

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✓ ***Rezyume***

***Insonning barcha faoliyati faqat energiya iste'moliga asoslangan. Energiyasiz organizmning faoliyatini, odamlar uchun barcha zaruriy manfaatlarning normal ishlashini tasavvur qilish mumkin emas. Bu omil inson ichida ham, uning muhitda mavjudligi uchun ham nihoyatda muhimdir. Ishlab chiqarishning turli sohalari mustaqil ishlay olmaydi, chunki ular doimiy energiya isemolini talab qiladi. Tirik tizimlar mavjudligi uchun doimo energiyani to'ldirishi va sarflashi kerak.***

***Ekotizimlardagi energiya jarayonlari termodinamikaning birinchi va ikkinchi qonunlariga bo'ysunadi. Ularga muvofiq energiya paydo bo'lmaydi va yo'qolmaydi, u faqat bir shakldan ikkinchisiga o'tadi (termodinamikaning birinchi qonuni - energiyaning saqlanish qonuni). Energiyaning bir qismi issiqlik shaklida tarqaladi.***

***Maqolada inson fiziologik holatining biofizik parametrlarga bog‘liqligi, termodinamik ko‘satgichlarning inson organizmidagi tadbiqi, ahamiyati va o‘zgarishi yoritilgan.***

***Kalit so‘zlar: Termodinamik ko‘rsatgichlar, termoregulyatsiya, energetik balans, issiqlik uzatish, issiqlik urushi, termodinamikaning birinchi va ikkinchi qonunlarining inson organizmiga tadbiqi.***

## Relevance

Due to the fact that the organism is in constant contact with the external environment, changes in external environmental factors have a significant impact on the organism. Human body temperature is normally 36.2-36.8ºC and is almost constant. Any temperature change of the external environment affects the homeostasis function of the human body, and a response reaction to this change is formed.

People living in regions with high temperature (Africa, desert, Sahara) are anatomically and physiologically adapted to high temperature. An example of anatomical adaptation is body color, which helps to keep them from constant heat. An example of physiological adaptation is the adaptation of visceral organs to high temperature, as well as the thickening of the skin [1].

Here a natural question arises: What is the energy balance of the body? We know that the food consumed by the human body is used for the following purposes: tissue regeneration, reserve formation, and growth in a young organism, etc. But the food consumed by the body is mainly used to compensate for the energy expenditure that occurs during the life of the body. This energy is the heat equivalent to the mechanical energy required to maintain the body temperature and replace the heat distributed to the environment, as well as for various activities in the body, including human work. The energy balance in the human body is taken in relation to a state of equilibrium of the body, i.e. in relation to the state in which energy expenditure exists in the body and this energy expenditure is coordinated with the heat released during digestion. In this case, the first law of thermodynamics is defined in relation to the body as follows: the amount of heat released in the body during the digestion of food is used to replace the part of the heat that escapes to the surrounding environment and is spent on the body's work [2].

It is not difficult to measure the mechanical work performed by a person under certain conditions. These measurements are carried out in accordance with the laws and formulas of physics. However, it is very difficult to directly determine the body's heat transfer to the surrounding environment.

Processes that ensure relatively constant maintenance of body temperature in humans are called thermoregulation. Thermoregulation is mainly divided into chemical thermoregulation related to the generation of heat and physical thermoregulation related to the transfer of heat to the surrounding environment.

The body transfers heat to the surrounding environment by heat conduction, convection, radiation, and evaporation. The ratio between them, all other things being equal, depends on the temperature,

humidity and movement of the environment surrounding the body. In this case, the surrounding environment means not only the environment that directly affects the organism (for example, air, water, etc.), but also the objects standing at a certain distance that can participate in heat exchange by radiation (for example, room walls, equipment, etc.) ) should also be understood [7].

Convection heat loss is normally through the air. The thermal conductivity of air is very small, but its convection can greatly increase the heat supply. In addition, air convection helps to evaporate moisture from the surface of the skin. Attempts are made to limit air movement to reduce convection. For this, a person wears clothes, and the walls of the dwelling are insulated with porous materials, and in porous materials there is still air.

The layer of the external environment, which is directly adjacent to the skin, is also very important for keeping the heat inside the body, because the main heat exchange of the body with the surrounding environment takes place in this layer. In humans, this layer is the main thermal protection of the body along with the air between the skin surface and clothes. The temperature on the surface of human clothes drops to 15-18 $^0$C [3].

Radiative heat loss occurs mainly from the surface of clothing and some exposed areas of the body. Heat is usually radiated towards the surfaces of surrounding bodies, which have a slightly lower temperature. Because, according to the second law of thermodynamics, in heat exchange, heat always passes from bodies with a higher temperature to bodies with a lower temperature.

Moisture evaporates from the surface of the skin and from the lungs. A person emits about 350 grams of water vapor on average per day along with exhaled air. When sweating is normal, about 500 grams of sweat evaporates from the surface of the skin in a day (when the ambient temperature is 16-18$^0$C). These numbers increase significantly when the temperature of the surrounding environment rises or when the muscles work intensively [4].

When the temperature of the surrounding environment is low, the release of heat increases mainly due to radiation. When the ambient temperature is high, heat loss through conduction and radiation decreases. In such conditions, heat is given due to the evaporation of sweat, which is greatly increased. If this is not enough, thermoregulation will be disturbed. This situation is called a heat war.

When the body temperature rises too high, heat loss from the body increases, and heat production is temporarily balanced. When the temperature drops, heat loss from the body increases [8].

The energy balance of the body is the ratio of the amount of energy provided by food and the amount of energy consumed by the body and released into the environment. The study of energy balance is of theoretical and practical importance (for example, to calculate the nutrition of people and farm animals). Energy balance is studied by calorimetry. Energy exchange is determined in kcal and kJ (1kcal = 4.19 kJ) [6].

The amount of energy released by a person can be determined directly by calorimetry, but this method requires sophisticated equipment. Another method - the method of indirect calorimetry is more convenient and based on the study of gas exchange. In this case, the respiration coefficient ($CO_2$ / $O_2$) is determined, and it turns out to be different during the oxidation of different substances. During the oxidation of carbohydrates, the respiration coefficient is equal to one; fat - 0.7; proteins - 0.81.

The amount of energy required to maintain the basic indicators of life is called the basal metabolism and it is determined in the morning, at rest, in a lying position, on an empty stomach, and in conditions of thermal comfort. Half of the main metabolism takes place in the liver (26%) and relaxed skeletal muscle (26%), the rest in the brain (18%), heart (9%) and others. The intensity of basal metabolism depends on age and gender. By the age of 70, it decreases significantly, it is lower in women than in men (1500 kcal per day for women, 1700 kcal for men).

The most convenient way to determine the main metabolism in the body is to determine it using the Reed formula (Reed table). In this case, it is possible to determine age-related metabolism by memorizing a simple table. Special tables (see Tables 1 and 2) allow you to determine the average statistical level of a person's basal metabolism according to the subject's height, age and body weight. By comparing these average values with the results obtained in the study of metabolism with the help of tools, it is possible to calculate the energy costs for performing a certain load [5].

***Table 1. Table for calculating the basic metabolism of men***

| A | | | | B | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Mass, kg** | **Kcal** | **Mass, kg** | **Kcal** | **Height, sm** | **Age** | | | | | |
| | | | | | **17** | **19** | **21** | **23** | **25** | **27** |
| 44 | 672 | 85 | 1235 | 40 | | | | | | |
| 45 | 685 | 86 | 1249 | 44 | | | | | | |
| 46 | 699 | 87 | 1263 | 48 | | | | | | |
| 47 | 713 | 88 | 1277 | 52 | | | | | | |
| 48 | 727 | 89 | 1290 | 56 | | | | | | |
| 49 | 740 | 90 | 1304 | 60 | | | | | | |
| 50 | 754 | 91 | 1318 | 64 | | | | | | |
| 51 | 768 | 92 | 1332 | 68 | | | | | | |
| 52 | 782 | 93 | 1345 | 72 | | | | | | |
| 53 | 795 | 94 | 1359 | 76 | | | | | | |
| 54 | 809 | 95 | 1373 | 80 | | | | | | |
| 55 | 823 | 96 | 1387 | 84 | | | | | | |
| 56 | 837 | 97 | 1406 | 88 | | | | | | |
| 57 | 850 | 98 | 1414 | 92 | | | | | | |
| 58 | 864 | 99 | 1428 | 96 | 113 | — | — | — | — | -- |
| 59 | 878 | 100 | 1442 | 100 | 153 | 128 | — | — | — | — |
| 60 | 892 | 101 | 1455 | 104 | 193 | 168 | — | — | — | — |
| 61 | 905 | 102 | 1469 | 108 | 233 | 208 | — | — | — | — |
| 62 | 919 | 103 | 1483 | 112 | 273 | 248 | — | — | — | — |
| 63 | 933 | 104 | 1497 | 116 | 313 | 288 | — | — | — | — |
| 64 | 947 | 105 | 1510 | 120 | 353 | 328 | — | — | — | — |
| 65 | 960 | 106 | 1524 | 124 | 393 | 368 | — | — | — | — |
| 66 | 974 | 107 | 1538 | 132 | 433 | 408 | — | — | — | — |
| 67 | 988 | 108 | 1552 | 134 | 473 | 448 | — | — | — | — |
| 68 | 1002 | 109 | 1565 | 136 | 513 | 488 | — | — | — | — |
| 69 | 1015 | 110 | 1579 | 140 | 553 | 528 | — | — | — | — |
| 70 | 1029 | 111 | 1593 | 144 | 593 | 568 | — | — | — | — |
| 71 | 1043 | 112 | 1607 | 148 | 633 | 608 | — | — | — | — |
| 72 | 1057 | 113 | 1620 | 152 | 673 | 648 | 619 | 605 | 592 | 578 |
| 73 | 1070 | 114 | 1634 | 156 | 713 | 678 | 669 | 625 | 612 | 598 |
| 74 | 1084 | 115 | 1648 | 160 | 743 | 708 | 659 | 645 | 631 | 618 |
| 75 | 1098 | 116 | 1662 | 164 | 773 | 738 | 679 | 665 | 652 | 638 |
| 76 | 1112 | 117 | 1675 | 168 | 803 | 768 | 699 | 685 | 672 | 658 |
| 77 | 1125 | 118 | 1689 | 172 | 823 | 788 | 719 | 705 | 692 | 678 |
| 78 | 1139 | 119 | 1703 | 176 | 843 | 808 | 729 | 725 | 718 | 698 |
| 79 | 1153 | 120 | 1717 | 180 | 863 | 828 | 759 | 745 | 732 | 718 |
| 80 | 1167 | 121 | 1730 | 184 | 883 | 848 | 779 | 765 | 752 | 738 |
| 81 | 1180 | 122 | 1744 | 188 | 903 | 868 | 799 | 785 | 772 | 758 |
| 82 | 1194 | 123 | 1758 | 192 | 923 | 888 | 819 | 805 | 792 | 778 |
| 83 | 1208 | 124 | 1772 | 196 | — | 908 | 839 | 825 | 812 | 798 |
| 84 | 1222 | | | | | | 859 | 845 | 832 | 818 |

***Table 2. Table for calculating the basal metabolism in women***

| A | | | | B | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Mass, kg** | **Kcal** | **Mass, kg** | **Kcal** | **Height, sm** | **Age** | | | | | |
| | | | | | **17** | **19** | **21** | **23** | **25** | **27** |
| 44 | 1076 | 85 | 1486 | 40 | | | | | | |
| 45 | 1085 | 86 | 1478 | 44 | | | | | | |
| 46 | 1095 | 87 | 1487 | 48 | | | | | | |
| 47 | 1105 | 88 | 1497 | 52 | | | | | | |
| 48 | 1114 | 89 | 1506 | 56 | | | | | | |
| 49 | 1124 | 90 | 1516 | 60 | | | | | | |
| 50 | 1133 | 91 | 1525 | 64 | | | | | | |
| 51 | 1143 | 92 | 1535 | 68 | | | | | | |
| 52 | 1152 | 93 | 1544 | 72 | | | | | | |
| 53 | 1162 | 94 | 1554 | 76 | | | | | | |
| 54 | 1172 | 95 | 1564 | 80 | | | | | | |
| 55 | 1181 | 96 | 1573 | 84 | | | | | | |
| 56 | 1191 | 97 | 1583 | 88 | | | | | | |
| 57 | 1200 | 98 | 1592 | 92 | | | | | | |
| 58 | 1210 | 99 | 1602 | 96 | 21 | | | | | |
| 59 | 1219 | 100 | 1661 | 100 | 5 | 14 | — | — | — | — |
| 60 | 1229 | 101 | 1621 | 104 | 19 | 2 | — | — | — | — |
| 61 | 1238 | 102 | 1631 | 108 | 27 | 18 | — | — | — | — |
| 62 | 1248 | 103 | 1640 | 112 | 43 | 34 | — | — | — | — |
| 63 | 1258 | 104 | 1650 | 116 | 59 | 50 | — | — | — | — |
| 64 | 1267 | 105 | 1659 | 120 | 75 | 66 | — | — | — | — |
| 65 | 1277 | 106 | 1669 | 124 | 101 | 82 | — | — | — | — |
| 66 | 1286 | 107 | 1678 | 128 | 123 | 114 | — | — | — | — |
| 67 | 1297 | 108 | 1688 | 132 | 127 | 116 | — | — | — | — |
| 68 | 1305 | 109 | 1698 | 136 | 139 | 130 | — | — | — | — |
| 69 | 1315 | 110 | 1707 | 140 | 155 | 146 | — | — | — | — |
| 70 | 1325 | 111 | 1717 | 144 | 171 | 162 | — | — | — | — |
| 71 | 1334 | 112 | 1726 | 148 | 187 | 178 | — | — | — | — |
| 72 | 1344 | 113 | 1736 | 152 | 201 | 192 | 183 | 174 | 164 | 155 |
| 73 | 1353 | 114 | 1745 | 156 | 215 | 206 | 190 | 181 | 172 | 162 |
| 74 | 1363 | 115 | 1755 | 160 | 229 | 220 | 198 | 188 | 179 | 170 |
| 75 | 1372 | 116 | 1764 | 164 | 243 | 234 | 205 | 196 | 186 | 177 |
| 76 | 1382 | 117 | 1774 | 168 | 255 | 246 | 213 | 203 | 194 | 184 |
| 77 | 1391 | 118 | 1784 | 172 | 267 | 258 | 220 | 211 | 201 | 192 |
| 78 | 1401 | 119 | 1793 | 176 | 279 | 270 | 227 | 218 | 209 | 199 |
| 79 | 1411 | 120 | 1803 | 180 | 291 | 282 | 235 | 225 | 216 | 207 |
| 80 | 1420 | 121 | 1812 | 184 | 303 | 294 | 242 | 233 | 223 | 214 |
| 81 | 1430 | 122 | 1822 | 188 | 313 | 304 | 250 | 240 | 231 | 221 |
| 82 | 1439 | 123 | 1831 | 192 | 322 | 341 | 257 | 248 | 238 | 229 |
| 83 | 1449 | 124 | 1847 | 196 | 333 | 324 | 264 | 255 | 246 | 236 |
| 84 | 1458 | 125 | 1851 | 200 | 343 | 334 | 272 | 262 | 253 | 244 |

The height and weight of the examined person are measured using a measuring tape and scales. Tables will be used later. The charts for determining the basal metabolic rate of men and women are different because men have an average of 10% higher basal metabolic rate than women. Tables are used as follows. If, for example, the examinee is a 25-year-old man with a height of 168 cm and a mass of 60 kg, then according to the tables for determining the basal metabolic rate of men (Table 1, part A), the number 892 is found. Next to the value of the human mass (table 1 part B) they are horizontally age (25 years) and vertical height (168 cm), the number 672 is located at the intersection of age and height

graphs. Adding both numbers (892 + 672 = 1564), you get the average statistical value of the normal basal metabolism of a man of a certain age, height and weight - 1564 kcal.

## Conclusion

***All human intellectual activity is based solely on the consumption of energy. Without energy, it is impossible to imagine the activity of the organism, the normal functioning of all the necessary benefits for people. This factor is extremely important both within a person and for his existence in the environment. Various areas of production cannot work independently, because they require constant energy production. Living systems for their existence must constantly replenish and expend energy.***

***Energy processes in ecosystems obey the first and second laws of thermodynamics. In accordance with them, energy does not arise and does not disappear, it only passes from one form to another (the first law of thermodynamics is the law of conservation of energy). Some of the energy is dissipated in the form of heat.***

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