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UTILITY PATENT

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PROCESS OF NON-INVASIVE DETERMINATION OF HOMEOSTASIS PARAMETERS OF THE BIOLOGICAL MEDIA OBJECT

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(54) Description of Utility Model

PROCESS OF NON-INVASIVE DETERMINATION OF HOMEOSTASIS PARAMETERS OF THE BIOLOGICAL MEDIA OBJECT

(57) Formula of Utility Model

1. Process of non-invasive determination of homeostasis parameters of the biological media object, which includes capture of spectral wavelength emitting from skin surface of the biological media object using detectors, processing of obtained data, using which and by means of mathematical model considering temperature parameters, anthropometric data of the biological media object, as well as atmosphere pressure parameters, interrelation of environment and blood formation system and their interaction is determined, in terms of which hematocrit, blood pH and blood oxygenation are estimated, as well as homeostasis parameters, based on which, a complex homeostasis parameter is determined. Also, these parameters are compared to their normal values using a processor, which is **different** in capturing infrared radiation of five active points of skin surface of the biological media object, spectral wavelength A of which is determined considering oscillation frequency of hydrogen proton and iodine atom with preliminary estimation of temperature indicators of the said points, interrelated with spectral wavelength, calculated by the following formula:

$$\lambda = T \cdot \omega_{н} / \omega_{i},$$

where λ is a spectral wavelength of infrared radiation of an active point of the skin surface;
T is a temperature indicator of an active point of the skin surface;
$\omega_{н}$ is an oscillation frequency of hydrogen proton at the temperature of 37°C;
ω_{i} is an oscillation frequency of iodine atom at the temperature of 37°C.
Later, taking into account obtained spectral wavelength A, length of linear coupling of nitrogen, oxygen and iron atoms in hemoglobin is determined depending on the temperature indicators of the measured active points, and changes of functional activity of a regulating system of lipoprotein and carbon metabolism per time unit are estimated due to the change in time for the interaction between protease-antiprotease balance (TIPAB) to be calculated by the following formula:

$$\lambda = T \times \frac{\omega_{н}}{\omega_{i}} \longleftrightarrow \frac{pH \times 174}{\sum T \times 60 \times 24} \times 16 \longleftrightarrow \frac{5 \times 0{,}131}{0{,}018} \longleftrightarrow 0{,}5 \times \frac{117}{292} \times \frac{3{,}8}{pH} \times \sum 3T \times \frac{103}{100} \times \frac{14}{7}$$

where λ is a spectral wavelength of infrared radiation of an active point of the skin surface;
T is a temperature indicator of an active point of the skin surface;
$\omega_{н}$ is an oscillation frequency of hydrogen proton at the temperature of 37°C;
ω_{i} is an oscillation frequency of iodine atom at the temperature of 37°C;
pH is a metabolic blood parameter;
174 is a atomic weight of arginine;
∑T is a total temperature indicator of 5 active points of the skin surface;
60 is a change of temperature indicator per time unit;
24 is a linear site of the amino acid sequence of the integral protein glycophorin A;
16 is a difference of a number of amino peptides, making part of thin and thick enkephalin strands;
5 is a ratio between total temperature indicator of 5 active points and abdominal temperature indicator;
0.131 is the Krohg constant;
0.018 is a distance between nitrogen and oxygen in hemoglobin at the temperature of 37°C;

0.5 is a ratio between abdominal temperature indicator and total temperature of carotid arteries, which characterizes ratio between proteins included into the internal membrane of mitochondria – 84 and proteins included into outer membrane of mitochondria;
117 is a location of arginine in the trypsinogen polypeptide chain;
292 is a location of glutamic acid in the α-1 antitrypsin polypeptide chain;
3.8 is a ration between length of somatic capillary (0.057 cm) and length of cardial capillary (0.015 cm);
∑3T is a total temperature of skin surface in the carotid regions and abdominal region;
103 is an atomic weight of nitrogen, oxygen, carbon, phosphor and sulphur, which are included as compounds of cell membrane cytoskeleton;
100 is an amount of percentage composition of myelin, being a part of lipids;
14 is a percentage composition of glycolipids, being a part of hepatocyte membrane;
7 is a percentage composition of phosphatidylserines, being a part of erythrocyte membrane. Based on the obtained data, a concentration of tryptophan, serotonin, dopamine beta hydrolase, lactic and pyruvic acids is determined, by parameters of which homeostasis parameters are evaluated such as insulin activity, growth hormone activity, pituitary thyrotropic hormone activity, pituitary antidiuretic hormone and blood circulation in the stomach and intestine segments.

2. The process as in par. 1, which is **different** in that such homeostasis parameter as an erythrocyte count is determined by the following formula:

$$K_{er} = \left(\frac{pH \times 174}{\sum T \times 60 \times 24} \times 16 \longleftrightarrow \frac{5 \times 0{,}131}{0{,}018} \right) : \left(0{,}5 \times \frac{117}{292} \times \frac{3{,}8}{pH} \times \sum 3T \times \frac{103}{100} \times \frac{14}{7} \right)$$

Where
K_{er} is an erythrocyte count, 10^6 mm,
pH is a metabolic blood parameter;
174 is a atomic weight of arginine;
∑T is a total temperature indicator of 5 active points of the skin surface;
60 is a change of temperature indicator per time unit;
24 is a linear site of the amino acid sequence of the integral protein glycophorin A;
16 is a difference of a number of amino peptides, making part of thin and thick enkephalin strands;
5 is a ratio between total temperature indicator of 5 active points and abdominal temperature indicator;
0.131 is the Krohg constant;
0.018 is a distance between nitrogen and oxygen in hemoglobin at the temperature of 37°C;
0.5 is a ratio between abdominal temperature indicator and total temperature of carotid arteries, which characterizes ratio between proteins included into the internal membrane of mitochondria – 84 and proteins included into outer membrane of mitochondria;
117 is a location of arginine in the trypsinogen polypeptide chain;
292 is a location of glutamic acid in the α-1 antitrypsin polypeptide chain;
3.8 is a ration between length of somatic capillary (0.057 cm) and length of cardial capillary (0.015 cm);
∑3T is a total temperature of skin surface in the carotid regions and abdominal region;
103 is an atomic weight of nitrogen, oxygen, carbon, phosphor and sulphur, which are included as compounds of cell membrane cytoskeleton;
100 is an amount of percentage composition of myelin, being a part of lipids;
14 is a percentage composition of glycolipids, being a part of hepatocyte membrane;
7 is a percentage composition of phosphatidylserines, being a part of erythrocyte membrane.

3. The process as in par. 1, which is **different** in that such homeostasis parameter as a hemoglobin count is determined by the following formula:

$$K_{Hb} = \frac{3{,}405 + \sum K_n}{461{,}0 \cdot 7{,}6 \cdot 10^{-5} + 32{,}0 \cdot t_{ab} \cdot P},$$

where K_{Hb} is a hemoglobin count, g/l
K_n is a total relative indicator of the biological media object,
3.405 is a kinetic translation energy of one mole of gas at the temperature of 273K, $kJmol^{-1}$,
461.0 is a mean-square velocity of oxygen with consideration for atmosphere conditions and patient's temperature, $m \cdot s^{-1}$,
$7.6 \cdot 10^{-5}$ is an average diameter of a red blood cell, mm,
32.0 is molar weight of oxygen, $gmol^{-1}$,
t_{ab} is a relative parameter of skin surface in the abdominal region,
P is a specific weight of urine, g/l.

4. The process as in par. 1, which is **different** in that such homeostasis parameter as a lymphocyte count is determined by the following formula:

$$K_{lim} = \frac{461{,}0 \cdot C_{O_2}}{3{,}405 \cdot C_{N_2}},$$

where K_{lim} is a lymphocyte count, %
C_{O2} is an oxygen concentration in the atmosphere, %,
C_{N2} is a nitrogen concentration in the atmosphere, %,
461.0 is a mean-square velocity of oxygen with consideration for atmosphere conditions and patient's temperature, $m \cdot s^{-1}$,
3.405 is a kinetic translation energy of one mole of gas at the temperature of 273K, $kJmol^{-1}$,

5. The process as in par. 1, which is **different** in that such homeostasis parameter as a leukocyte count is determined by the following formula:

$$K_l = \frac{\Delta t\lambda CO_2}{\Delta t\lambda N_2O} \frac{P}{0{,}131},$$

where K_l is a leukocyte count, 10^3 m,
$\Delta t\lambda CO_2$ is a time-dependent spectral wavelength of CO_2 absorption, nm,
$\Delta t\lambda N_2O$ is a time-dependent spectral wavelength of N_2O absorption, nm,
P is a specific weight of urine, g/l.
0.131 is the Krohg constant.

6. The process as in par. 1, which is **different** in that such homeostasis parameter as a monocyte count is determined by the following formula:

$$K_m = \frac{\Delta t\lambda CO_2}{\Delta t\lambda N_2O} \frac{C_{N_2}}{V_v},$$

where K_m is a monocyte count, %,
$\Delta t\lambda CO_2$ is a time-dependent spectral wavelength of CO_2 absorption, nm,
$\Delta t\lambda N_2O$ is a time-dependent spectral wavelength of N_2O absorption, nm,
C_{N2} is a nitrogen concentration in the atmosphere, %,
V_v is relative air humidity.

7. The process as in par. 1, which is **different** in that such homeostasis parameter as a segmented neutrophil count is determined by the following formula:

$$K_{ns} = \frac{\Delta t\lambda CO_2}{\Delta t\lambda N_2O} \frac{C_{N_2}}{},$$

where K_{ns} is a segmented neutrophil count, %,
$\Delta t\lambda CO_2$ is a time-dependent spectral wavelength of CO_2 absorption, nm,
$\Delta t\lambda N_2O$ is a time-dependent spectral wavelength of N_2O absorption, nm,
C_{N2} is a nitrogen concentration in the atmosphere, %.

8. The process as in par. 1, which is **different** in that such homeostasis parameter as a band neutrophil count is determined by the following formula:

$$K_{np} = \frac{K_l}{K_m} \frac{C_{N_2}}{K_{ns}}$$

where K_{np} is a band neutrophil count , %,
where K_l is a leukocyte count, 10^3 m,
C_{N2} is a nitrogen concentration in the atmosphere, %,
where K_m is a monocyte count, %,
where K_{ns} is a segmented neutrophil count, %.

9. The process as in par. 1, which is **different** in that such homeostasis parameter as an eosinophil count is determined by the following formula:

$$K_e = \frac{K_{ns} - K_m}{D},$$

where K_e is an eosinophil count, %
where K_{ns} is a segmented neutrophil count, %.

where K_m is a monocyte count, %,
D is a respiration rate of the object, respirations per minute.

10. The process as in par. 1, which is **different** in that such homeostasis parameter as erythrocyte sedimentation rate (ESR) is determined by the following formula:

$$ШОЕ = \frac{\sum K_n}{60} \frac{K_l}{P},$$

where ШОЕ is erythrocyte sedimentation rate, mm/hour,
K_n is a total relative indicator of the biological media object,
P is a specific weight of urine, g/l.
where K_l is a leukocyte count, 10^3 m,
60 - number of minutes in an hour.

11. The process as in par. 1, which is **different** in that such homeostasis parameter as gas composition of the blood is determined depending on quantitative composition of the blood and gas composition of the surrounding atmosphere, with arterial blood oxygenation being calculated by the following formula:

$$C_{O_2ar} = \frac{100}{\Delta t\lambda CO_2} \frac{K_{hb}}{K_{er}} - \frac{t_{ab}}{0{,}131},$$

where C_{O2ar} is an arterial blood oxygenation, %,
$\Delta t\lambda CO_2$ is a time-dependent spectral wavelength of CO_2 absorption, nm,
K_{er} is an erythrocyte count, 10^6 mm,
0.131 is the Krohg constant;
t_{ab} is a relative parameter of skin surface in the abdominal region,
K_{Hb} is a hemoglobin count, g %/100 ml, and venous blood oxygenation being calculated by the following formula:

$$C_{O_2v} = \frac{100}{\Delta t\lambda N_2O} K_{ns} - \frac{t_{л.с.а.}}{0{,}131},$$

where C_{O2v} is an arterial blood oxygenation, %,
$\Delta t\lambda N_2O$ is a time-dependent spectral wavelength of N_2O absorption, nm,
$T_{л.с.а.}$ is a relative parameter of skin surface in the left carotid artery region;
0.131 is the Krohg constant;
where K_{ns} is a segmented neutrophil count, %,

12. The process as in par. 1, which is **different** in that such homeostasis parameter as hemodynamic parameter of the blood (systolic blood pressure) is determined depending on gas composition of the blood, morphometric parameters of the microcirculatory bloodstream, as well as depending on anthropometric parameters of the biological media object by means of evaluation of changes of reduction-oxidation reactions by the following formula:

$$АДС = \frac{ФСВ}{УО} \frac{\sum K_n}{(C_{O_2ar} - C_{O_2v}) \cdot 0{,}131},$$

where АДС is the systolic arterial pressure, mmHb,
ФСВ is the cardiac output fraction, ml,
УО is the stroke output, ml;
C_{O2ar} is an arterial blood oxygenation, %,
C_{O2v} is an arterial blood oxygenation, %,
K_n is a total relative indicator of the biological media object,
0.131 is the Krohg constant.

13. The process as in par. 1, which is **different** in that such homeostasis parameter as a metabolic indicator of the blood, pM, is determined depending on change in the spectral wavelength of CO_2 and N_2O absorption and arterial blood oxygenation:

$$P_H = \frac{\Delta t\lambda CO_2 \cdot O_{цк} \cdot 0{,}131 \cdot C_{O_2ar}}{\Delta t\lambda CN_2O \cdot 100\%},$$

where $\Delta t\lambda CO_2$ is a time-dependent spectral wavelength of CO_2 absorption, nm,
$\Delta t\lambda N_2O$ is a time-dependent spectral wavelength of N_2O absorption, nm,
C_{O2ar} is an arterial blood oxygenation, %,
$O_{цк}$ is a circulating blood volume per 1 kh weight, l,
0.131 is the Krohg constant.

14. Process as per par. 1-13 which is **different** in that the complex homeostasis parameter is determined depending on the ratio between total relative quantitative parameter of the biological media object and difference between nitrogen and oxygen concentration in the atmosphere and volume of plasma sodium, potassium, related to the spectral wavelength of CO_2 and N_2O absorption, by the following formula:

$$O_r = \frac{\Sigma K_n}{(C_{N_2at} - C_{O_2at}) \cdot 0{,}131} \cdot \frac{\Delta t\lambda CO_2}{\Delta t\lambda N_2O} \cdot \frac{K_{hb} \cdot C_K \cdot P \cdot T_{ab}}{K_{er} \cdot C_{Na} \cdot (t_{л.с.a.} - t_{п.с.a})} 100\%,$$

where O_r is the complex homeostasis parameter, %,
K_n is a total relative indicator of the biological media object,
C_{N2at} is a nitrogen concentration in the atmosphere, %,
C_{O2at} is an oxygen concentration in the atmosphere, %,
$\Delta t\lambda CO_2$ is a time-dependent spectral wavelength of CO_2 absorption, nm,
$\Delta t\lambda N_2O$ is a time-dependent spectral wavelength of N_2O absorption, nm
0.131 is the Krohg constant,
K_{Hb} is a hemoglobin count,
K_{er} is an erythrocyte count
$T_{л.с.a.}$ is a relative parameter of skin surface in the left carotid artery region;
$T_{п.с.a.}$ is a relative parameter of skin surface in the right carotid artery region;
C_K is a potassium concentration, mmol/l,
C_{Na} is a sodium concentration, mmol/l,

15. Process as per par. 1-14 which is **different** in that homeostasis parameters are determined by means of non-linear programming.

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