amino acids are contained in large amounts in blood, and their physical properties are relatively similar to each other. Amino acids therefore have desirable properties to serve as biomarkers, for example, to enable precise analysis.

[0005] It has been reported that differences of plasma amino acid concentrations are a risk factor of future cerebral and cardiovascular events (Non Patent Literatures 1 to 4). As a prior patent, Patent Document 1 has been published, which relates to a method of evaluating a future state of cardiovascular events using amino acid concentrations in blood.

PRIOR ART REFERENCES

PATENT DOCUMENT

[0006] Patent Document 1: JP-A-2013-178238

NON PATENT LITERATURE

[0007] Non patent Literature 1: Ruiz-Canela M. et al. Clin. Chem. 2016, 62, 582-592

Non patent Literature 2: Shah SH. et al. Circ. Cardiovasc. Genet. 2010, 3, 207-214

Non patent Literature 3: Shah SH. et al. Am. Heart. J. 2012, 163, 844-850

Non patent Literature 4: Magnusson M. et al. 2013, Eur. Heart. J. 34, 198201989

DISCLOSURE OF INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION

[0008] However, there has been a demand for further precision in development of determination techniques related to future risk of developing cerebral and cardiovascular

events using blood amino acid concentrations.

[0009] Embodiments of the present invention provide an evaluating method, a calculating method, an evaluating apparatus, a calculating apparatus, an evaluating program product, a calculating program product, a recording medium, an evaluating system, and a terminal apparatus, which can provide reliable information that may be helpful in identifying future risk of developing cerebral and cardiovascular events.

MEANS FOR SOLVING PROBLEM

[0010] According to a first aspect of the present disclosure, there is provided an evaluating method including an evaluation step of evaluating future risk of developing cerebral and cardiovascular events for a subject to be evaluated, using (i) concentration values of Gly, Met, and at least two amino acids of Cit, Trp, Val, His, Pro, and Tyr in blood of the subject, or (ii) a value of a formula calculated using the concentration values and the formula including explanatory variables to be substituted with the concentration values.

[0011] In the present description, cerebral and cardiovascular events include aortic dissection, coronary diseases (myocardial infarction, heart failure, administration of percutaneous coronary intervention (PCI), and the like), and cerebrovascular disorders (stroke (cerebral infarction, intracerebral hemorrhage, subarachnoid hemorrhage), and the like).

[0012] In the present description, various amino acids are mainly written in abbreviations, the formal names of these are as follows.

(Abbreviation)	(Formal name)
Ala	Alanine
Arg	Arginine
Asn	Asparagine
Cit	Citrulline
Gln	Glutamine
Gly	Glycine
His	Histidine
Ile	Isoleucine
Leu	Leucine
Lys	Lysine
Met	Methionine
Orn	Ornithine
Phe	Phenylalanine
Pro	Proline
Ser	Serine
Thr	Threonine
Trp	Tryptophan
Tyr	Tyrosine
Val	Valine

[0014] In an embodiment of the first aspect, the at least two amino acids include any one or both of Cit and Trp.

[0015] In an embodiment of the first aspect, the at least two amino acids include Val.

[0016] In an embodiment of the first aspect, the evaluating step is executed by a control unit of an information processing apparatus.

[0017] According to a second aspect of the present disclosure, there is provided a calculating method including a calculating step of using (i) concentration values of Gly, Met, and at least two amino acids of Cit, Trp, Val, His, Pro, and

Tyr in blood of a subject to be evaluated, and (ii) a formula for evaluating future risk of developing cerebral and cardiovascular events, including explanatory variables to be substituted with the concentration values, to calculate a value of the formula.

[0019] In an embodiment of the second aspect, the at least two amino acids include any one or both of Cit and Trp.

[0020] In an embodiment of the second aspect, the at least two amino acids include Val.

[0021] In an embodiment of the second aspect, the evaluating step is executed by a control unit of an information processing apparatus.

[0022] According to a third aspect of the present disclosure, there is provided an evaluating apparatus including a control unit, wherein control unit includes an evaluating unit that evaluates future risk of developing cerebral and cardiovascular events for a subject to be evaluated, using (i) concentration values of Gly, Met, and at least two amino acids of Cit, Trp, Val, His, Pro, and Tyr in blood of the subject, or (ii) a value of a formula calculated using the concentration values and the formula including explanatory variables to be substituted with the concentration values.

[0023] In an embodiment of the third aspect, the evaluating apparatus is communicatively connected via a network to a terminal apparatus that provides concentration data on the concentration values, or the value of the formula. The control unit further includes: a data-receiving unit that receives the concentration data or the value of the formula transmitted from the terminal apparatus; and a result-sending unit that transmits an evaluation result obtained by the evaluating unit to the terminal apparatus. The evaluating

unit uses the concentration values included in the concentration data or the value of the formula received by the data-receiving unit.

[0024] According to a fourth aspect of the present disclosure, there is provided a calculating apparatus including a control unit, wherein the control unit includes a calculating unit that uses (i) concentration values of Gly, Met, and at least two amino acids of Cit, Trp, Val, His, Pro, and Tyr in blood of a subject to be evaluated, and (ii) a formula for evaluating future risk of developing cerebral and cardiovascular events, including explanatory variables to be substituted with the concentration values, to calculate a value of the formula.

[0025] According to a fifth aspect of the present disclosure, there is provided an evaluating program for causing a control unit of an information processing apparatus to execute: an evaluating step of evaluating future risk of developing cerebral and cardiovascular events for a subject to be evaluated, using (i) concentration values of Gly, Met, and at least two amino acids of Cit, Trp, Val, His, Pro, and Tyr in blood of the subject, or (ii) a value of a formula calculated using the concentration values and the formula including explanatory variables to be substituted with the concentration values.

[0026] According to a sixth aspect of the present disclosure, there is provided a calculating program for causing a control unit of an information processing apparatus to execute: a calculating step of using (i) concentration values of Gly, Met, and at least two amino acids of Cit, Trp, Val, His, Pro, and Tyr in blood of a subject to be evaluated, and (ii) a formula for evaluating future risk of developing cerebral and cardiovascular events, including explanatory

variables to be substituted with the concentration values, to calculate a value of the formula.

[0027] According to a seventh aspect of the present disclosure, there is provided a computer readable recording medium storing the evaluating program or the calculating program. Specifically, the recording medium according to the seventh aspect is a non-transitory computer readable recording medium including programmed instructions for causing an information processing apparatus to execute the evaluating method or the calculating method.

[0028] According to an eighth aspect of the present disclosure, there is provided an evaluating system including: an evaluating apparatus including a control unit; and a terminal apparatus including a control unit. The evaluating apparatus and the terminal apparatus are communicatively connected to each other via a network. The control unit of the terminal apparatus includes: a data-sending unit that transmits (i) concentration data on concentration values of Gly, Met, and at least two amino acids of Cit, Trp, Val, His, Pro, and Tyr in blood of a subject to be evaluated, or (ii) a value of a formula calculated using the concentration values and the formula including explanatory variables to be substituted with the concentration values, to the evaluating apparatus; and a result-receiving unit that receives an evaluation result on future risk of developing cerebral and cardiovascular events, transmitted from the evaluating apparatus. The control unit of the evaluating apparatus includes: a data-receiving unit that receives the concentration data or the value of the formula transmitted from the terminal apparatus; an evaluating unit that evaluates future risk of developing cerebral and cardiovascular events for the subject, using the concentration values included in

the concentration data or the value of the formula received by the data-receiving unit; and a result-sending unit that transmits the evaluation result obtained by the evaluating unit to the terminal apparatus.

[0029] According to a nineth aspect of the present disclosure, there is provided a terminal apparatus including a control unit. The control unit includes a result-obtaining unit that obtains an evaluation result on future risk of developing cerebral and cardiovascular events. The evaluation result is a result of evaluating future risk of developing cerebral and cardiovascular events for a subject to be evaluated, using (i) concentration values of Gly, Met, and at least two amino acids of Cit, Trp, Val, His, Pro, and Tyr in blood of the subject, or (ii) a value of a formula calculated using the concentration values and the formula including explanatory variables to be substituted with the concentration values.

[0030] In an embodiment of the nineth aspect, the terminal apparatus is communicatively connected via a network to an evaluating apparatus that evaluates future risk of developing cerebral and cardiovascular events. The control unit includes a data-sending unit that transmits concentration data on the concentration values, or the value of the formula, to the evaluating apparatus. The result-obtaining unit receives the evaluation result transmitted from the evaluating apparatus.

EFFECT OF THE INVENTION

[0031] According to embodiments of the present disclosure, reliable

CLAIMS

1. An evaluating method comprising:

an evaluation step of evaluating future risk of developing cerebral and cardiovascular events for a subject to be evaluated, using (i) concentration values of Gly, Met, and at least two amino acids of Cit, Trp, Val, His, Pro, and Tyr in blood of the subject, or (ii) a value of a formula calculated using the concentration values and the formula including explanatory variables to be substituted with the concentration values.

2. The evaluating method according to claim 1, wherein the at least two amino acids include any one or both of Cit and Trp.

3. The evaluating method according to any one of claims 1 or 2, wherein the at least two amino acids include Val.

4. The evaluating method according to any one of claims 1 to 3, wherein the evaluating step is executed by a control unit of an information processing apparatus.

5. A calculating method comprising:

a calculating step of using (i) concentration values of Gly, Met, and at least two amino acids of Cit, Trp, Val, His, Pro, and Tyr in blood of a subject to be evaluated, and (ii) a formula for evaluating future risk of developing cerebral and cardiovascular events, including explanatory variables to be substituted with the concentration values, to calculate a value of the formula.

6. The calculating method according to claim 5, wherein the at least two amino acids include any one or both of Cit

and Trp.

7. The evaluating method according to any one of claims 5 or 6, wherein the at least two amino acids include Val.

8. The evaluating method according to any one of claims 5 to 7, wherein the evaluating step is executed by a control unit of an information processing apparatus.

9. An evaluating apparatus comprising a control unit, wherein the control unit includes:

an evaluating unit that evaluates future risk of developing cerebral and cardiovascular events for a subject to be evaluated, using (i) concentration values of Gly, Met, and at least two amino acids of Cit, Trp, Val, His, Pro, and Tyr in blood of the subject, or (ii) a value of a formula calculated using the concentration values and the formula including explanatory variables to be substituted with the concentration values.

10. The evaluating apparatus according to claim 9, being communicatively connected via a network to a terminal apparatus that provides concentration data on the concentration values, or the value of the formula,

wherein the control unit further includes:

a data-receiving unit that receives the concentration data or the value of the formula transmitted from the terminal apparatus; and

a result-sending unit that transmits an evaluation result obtained by the evaluating unit to the terminal apparatus,

wherein the evaluating unit uses the concentration values included in the concentration data or the value of the formula received by the data-receiving unit.

11. A calculating apparatus comprising a control unit, wherein the control unit includes:

a calculating unit that uses (i) concentration values of Gly, Met, and at least two amino acids of Cit, Trp, Val, His, Pro, and Tyr in blood of a subject to be evaluated, and (ii) a formula for evaluating future risk of developing cerebral and cardiovascular events, including explanatory variables to be substituted with the concentration values, to calculate a value of the formula.

12. An evaluating program for causing a control unit of an information processing apparatus to execute:

an evaluating step of evaluating future risk of developing cerebral and cardiovascular events for a subject to be evaluated, using (i) concentration values of Gly, Met, and at least two amino acids of Cit, Trp, Val, His, Pro, and Tyr in blood of the subject, or (ii) a value of a formula calculated using the concentration values and the formula including explanatory variables to be substituted with the concentration values.

13. A calculating program for causing a control unit of an information processing apparatus to execute:

a calculating step of using (i) concentration values of Gly, Met, and at least two amino acids of Cit, Trp, Val, His, Pro, and Tyr in blood of a subject to be evaluated, and (ii) a formula for evaluating future risk of developing cerebral and cardiovascular events, including explanatory variables to be substituted with the concentration values, to calculate a value of the formula.

14. A computer readable recording medium storing the evaluating program according to claim 12 or the calculating program according to claim 13.

15. An evaluating system comprising:

an evaluating apparatus including a control unit; and

a terminal apparatus including a control unit,

wherein the evaluating apparatus and the terminal apparatus are communicatively connected to each other via a network,

the control unit of the terminal apparatus includes:

a data-sending unit that transmits (i) concentration data on concentration values of Gly, Met, and at least two amino acids of Cit, Trp, Val, His, Pro, and Tyr in blood of a subject to be evaluated, or (ii) a value of a formula calculated using the concentration values and the formula including explanatory variables to be substituted with the concentration values, to the evaluating apparatus; and

a result-receiving unit that receives an evaluation result on future risk of developing cerebral and cardiovascular events, transmitted from the evaluating apparatus, and

the control unit of the evaluating apparatus includes:

a data-receiving unit that receives the concentration data or the value of the formula transmitted from the terminal apparatus;

an evaluating unit that evaluates future risk of developing cerebral and cardiovascular events for the subject, using the concentration values included in the concentration data or the value of the formula received by the data-receiving unit; and

a result-sending unit that transmits the evaluation result obtained by the evaluating unit to the terminal apparatus.

16. A terminal apparatus comprising a control unit,

wherein the control unit includes a result-obtaining unit that obtains an evaluation result on future risk of developing cerebral and cardiovascular events,

wherein the evaluation result is a result of evaluating future risk of developing cerebral and cardiovascular events for a subject to be evaluated, using (i) concentration values of Gly, Met, and at least two amino acids of Cit, Trp, Val, His, Pro, and Tyr in blood of the subject, or (ii) a value of a formula calculated using the concentration values and the formula including explanatory variables to be substituted with the concentration values.

17. The terminal apparatus according to claim 16, being communicatively connected via a network to an evaluating apparatus that evaluates future risk of developing cerebral and cardiovascular events,

wherein the control unit includes a data-sending unit that transmits concentration data on the concentration values, or the value of the formula, to the evaluating apparatus,

the result-obtaining unit receives the evaluation result transmitted from the evaluating apparatus.