

CLAIMS

1. A method for determining whether a subject is at risk of developing a metabolic condition related to the nutritional state of the blood;

5 wherein the method comprises determining in a biological sample obtained from the subject a quantitative value of at least one biomarker of the following in the biological sample:

- glycoprotein acetyls,
- albumin,
- 10 - ratio of docosahexaenoic acid to total fatty acids,
- ratio of linoleic acid to total fatty acids,
- ratio of monounsaturated fatty acids and/or of oleic acid to total fatty acids,
- ratio of omega-3 fatty acids to total fatty acids,
- 15 - ratio of omega-6 fatty acids to total fatty acids,
- fatty acid degree of unsaturation,
- docosahexaenoic acid,
- linoleic acid,
- omega-3 fatty acids,
- 20 - omega-6 fatty acids,
- citrate,
- pyruvate,
- alanine,
- glutamine,
- 25 - histidine,
- leucine,
- phenylalanine,
- valine; and

30 comparing the quantitative value(s) of the at least one biomarker to a control sample or to a control value;

 wherein an increase or a decrease in the quantitative value(s) of the at least one biomarker, when compared to the control sample or to the control value, is/are indicative of the subject having an increased risk of developing the metabolic condition related to the nutritional state of the blood;

35 wherein the at least one biomarker comprises or is glycoprotein acetyls; and

wherein the metabolic condition related to the nutritional state of the blood comprises or is vitamin deficiency and/or disorder of mineral metabolism.

2. The method according to claim 1, wherein the method
5 comprises determining in the biological sample quantitative values of a plurality of the biomarkers, such as two, three, four, five or more of the biomarkers.

3. The method according to claim 1 or 2, wherein the
method comprises determining in the biological sample obtained
10 from the subject a quantitative value of the following biomarkers:

- glycoprotein acetyls;
- albumin; and

comparing the quantitative value(s) of the biomarkers to a control sample or to a control value(s);

15 wherein an increase or a decrease in the quantitative value(s) of the biomarkers, when compared to the control sample or to the control value, is/are indicative of the subject having an increased risk of developing the metabolic condition related to the nutritional state of the blood.

20 4. The method according to any one of claims 1 - 3, wherein the method comprises determining in the biological sample obtained from the subject a quantitative value of the following biomarkers:

- glycoprotein acetyls,
- 25 - at least one fatty acid measure(s) of the following:
ratio of docosahexaenoic acid to total fatty acids,
docosahexaenoic acid, ratio of linoleic acid to total fatty acids,
linoleic acid, ratio of monounsaturated fatty acids and/or of oleic
acid to total fatty acids, ratio of omega-3 fatty acids to total
30 fatty acids, omega-3 fatty acids, ratio of omega-6 fatty acids to
total fatty acids, omega-6 fatty acids, fatty acid degree of
unsaturation; and

comparing the quantitative value(s) of the biomarkers to a control sample or to a control value(s);

35 wherein an increase or a decrease in the quantitative value(s) of the biomarkers, when compared to the control sample or to the control value, is/are indicative of the subject having an increased risk of developing the metabolic condition related to the nutritional state of the blood.

5. The method according to any one of claims 1 - 4, wherein the metabolic condition related to the nutritional state comprises or is iron deficiency anemia, vitamin deficiency, and/or disorder of mineral metabolism.

5 6. The method according to any one of claims 1 - 5, wherein the metabolic condition related to the nutritional state of the blood comprises or is iron deficiency anemia (D50); vitamin B12 deficiency anemia (D51); deficiency of other B group vitamins (E53); vitamin D deficiency (E55); deficiency of other nutrient
10 elements (E61); and/or disorder of mineral metabolism (E83).

 7. The method according to any one of claims 1 - 6, wherein the metabolic condition related to the nutritional state and/or fluid balance of the blood comprises or is other iron
15 deficiency anemia (D50.8); iron deficiency anemia, unspecified (D50.9); vitamin B12 deficiency anemia due to intrinsic factor deficiency (D51.0); disorder of phosphorus metabolism and/or phosphatases (E83.3);; deficiency of other specified B group vitamins (E53.8; vitamin D deficiency, unspecified (E55.9); iron
20 deficiency (E61.1); disorder of magnesium metabolism (E83.4); and/or disorder of calcium metabolism (E83.5).

 8. The method according to any one of claims 1 - 7, wherein the quantitative value of the at least one biomarker is/are measured using nuclear magnetic resonance spectroscopy.

 9. The method according to any one of claims 1 - 8,
25 wherein the method further comprises determining whether the subject is at risk of developing the metabolic condition related to the nutritional state of the blood using a risk score, hazard ratio, odds ratio, and/or predicted absolute risk or relative risk calculated on the basis of the quantitative value(s) of the at
30 least one biomarker or of the plurality of the biomarkers.

 10. The method according to claim 9, wherein the risk score, hazard ratio, odds ratio, and/or predicted relative risk and/or absolute risk is calculated on the basis of at least one further measure, such as a characteristic of the subject.

35 11. The method according to claim 10, wherein the characteristic of the subject includes one or more of age, height, weight, body mass index, race or ethnic group, smoking, and/or family history of anemias and/or metabolic conditions related to the nutritional state of the blood.

12. The method according to any one of claims 1 - 11, wherein the method comprises determining in the biological sample obtained from the subject a quantitative value of the following biomarkers:

- 5 - glycoprotein acetyls,
- albumin,
- ratio of docosahexaenoic acid to total fatty acids,
- ratio of linoleic acid to total fatty acids,
- ratio of monounsaturated fatty acids and/or of oleic
- 10 acid to total fatty acids,
- ratio of omega-3 fatty acids to total fatty acids,
- ratio of omega-6 fatty acids to total fatty acids,
- fatty acid degree of unsaturation,
- docosahexaenoic acid,
- 15 - linoleic acid,
- omega-3 fatty acids,
- omega-6 fatty acids,
- citrate,
- pyruvate,
- 20 - alanine,
- glutamine,
- histidine,
- leucine,
- phenylalanine, and
- 25 - valine; and

comparing the quantitative value(s) of the biomarkers to a control sample or to a control value(s);

wherein an increase or a decrease in the quantitative value(s) of the biomarkers, when compared to the control sample or to the control value, is/are indicative of the subject having an increased risk of developing the metabolic condition related to the nutritional state of the blood.

13. A method for determining whether a subject is at risk of developing an anemia;

wherein the method comprises determining in a biological sample obtained from the subject a quantitative value of at least one biomarker of the following in the biological sample:

- glycoprotein acetyls,
- albumin,

- ratio of docosahexaenoic acid to total fatty acids,
- ratio of linoleic acid to total fatty acids,
- ratio of monounsaturated fatty acids and/or of oleic acid to total fatty acids,
- ratio of omega-3 fatty acids to total fatty acids,
- ratio of omega-6 fatty acids to total fatty acids,
- fatty acid degree of unsaturation,
- docosahexaenoic acid,
- linoleic acid,
- omega-3 fatty acids,
- omega-6 fatty acids,
- citrate,
- pyruvate,
- alanine,
- glutamine,
- histidine,
- leucine,
- phenylalanine,
- valine; and

comparing the quantitative value(s) of the at least one biomarker to a control sample or to a control value;

wherein an increase or a decrease in the quantitative value(s) of the at least one biomarker, when compared to the control sample or to the control value, is/are indicative of the subject having an increased risk of developing the anemia;

wherein the at least one biomarker comprises or is glycoprotein acetyls.

14. The method according to claim 13, wherein the method comprises determining in the biological sample quantitative values of a plurality of the biomarkers, such as two, three, four, five or more of the biomarkers.

15. The method according to any one of claims 13 - 14, wherein the method comprises determining in the biological sample obtained from the subject a quantitative value of the following biomarkers:

- glycoprotein acetyls;
- albumin; and

comparing the quantitative value(s) of the biomarkers to a control sample or to a control value(s);

wherein an increase or a decrease in the quantitative value(s) of the biomarkers, when compared to the control sample or
 5 to the control value, is/are indicative of the subject having an increased risk of developing the anemia.

16. The method according to any one of claims 13 - 15, wherein the method comprises determining in the biological sample obtained from the subject a quantitative value of the following
 10 biomarkers:

- glycoprotein acetyls,
- at least one fatty acid measure(s) of the following:
 ratio of docosahexaenoic acid to total fatty acids,
 docosahexaenoic acid, ratio of linoleic acid to total fatty acids,
 15 linoleic acid, ratio of monounsaturated fatty acids and/or of oleic acid to total fatty acids, ratio of omega-3 fatty acids to total fatty acids, omega-3 fatty acids, ratio of omega-6 fatty acids to total fatty acids, omega-6 fatty acids, fatty acid degree of unsaturation; and

20 comparing the quantitative value(s) of the biomarkers to a control sample or to a control value(s);

wherein an increase or a decrease in the quantitative value(s) of the biomarkers, when compared to the control sample or to the control value, is/are indicative of the subject having an
 25 increased risk of developing the anemia.

17. The method according to any one of claims 13 - 16, wherein the anemia comprises or is iron deficiency anemia (D50); vitamin B12 deficiency anemia (D51); other aplastic anemia or other bone marrow failure syndrome (D61); anemia in chronic diseases
 30 classified elsewhere (D63); or other anemia (D64).

18. The method according to any one of claims 13 - 17, wherein the anemia comprises or is other iron deficiency anemia (D50.8); iron deficiency anemia, unspecified (D50.9); vitamin B12 deficiency anemia due to intrinsic factor deficiency (D51.0);
 35 aplastic anemia, unspecified (D61.9); and/or anemia in neoplastic disease (D63.0).

19. The method according to any one of claims 13 - 18, wherein the anemia comprises or is iron deficiency anemia and/or other anemia.

20. The method according to any one of claims 13 - 19, wherein the quantitative value of the at least one biomarker is/are measured using nuclear magnetic resonance spectroscopy.

5 21. The method according to any one of claims 13 - 20, wherein the method further comprises determining whether the subject is at risk of developing the anemia using a risk score, hazard ratio, odds ratio, and/or predicted absolute risk or relative risk calculated on the basis of the quantitative value(s)
10 of the at least one biomarker or of the plurality of the biomarkers.

22. The method according to claim 21, wherein the risk score, hazard ratio, odds ratio, and/or predicted relative risk and/or absolute risk is calculated on the basis of at least one
15 further measure, such as a characteristic of the subject.

23. The method according to claim 22, wherein the characteristic of the subject includes one or more of age, height, weight, body mass index, race or ethnic group, smoking, and/or family history of anemias and/or metabolic conditions related to
20 the nutritional state of the blood.

24. The method according to any one of claims 13 - 23, wherein the method comprises determining in the biological sample obtained from the subject a quantitative value of the following biomarkers:

- 25 - glycoprotein acetyls,
- albumin,
- ratio of docosahexaenoic acid to total fatty acids,
- ratio of linoleic acid to total fatty acids,
- ratio of monounsaturated fatty acids and/or of oleic
30 acid to total fatty acids,
- ratio of omega-3 fatty acids to total fatty acids,
- ratio of omega-6 fatty acids to total fatty acids,
- fatty acid degree of unsaturation,
- docosahexaenoic acid,
- 35 - linoleic acid,
- omega-3 fatty acids,
- omega-6 fatty acids,
- citrate,
- pyruvate,

- alanine,
- glutamine,
- histidine,
- leucine,
- 5 - phenylalanine, and
- valine; and

comparing the quantitative value(s) of the biomarkers to a control sample or to a control value(s);

10 wherein an increase or a decrease in the quantitative value(s) of the biomarkers, when compared to the control sample or to the control value, is/are indicative of the subject having an increased risk of developing the anemia.

15 25. A method for determining whether a subject is at risk of developing a metabolic condition related to the fluid balance of the blood;

wherein the method comprises determining in a biological sample obtained from the subject a quantitative value of at least one biomarker of the following in the biological sample:

- 20 - glycoprotein acetyls,
- albumin,
- ratio of docosahexaenoic acid to total fatty acids,
- ratio of linoleic acid to total fatty acids,
- ratio of monounsaturated fatty acids and/or of oleic acid to total fatty acids,
- 25 - ratio of omega-3 fatty acids to total fatty acids,
- ratio of omega-6 fatty acids to total fatty acids,
- fatty acid degree of unsaturation,
- docosahexaenoic acid,
- linoleic acid,
- 30 - omega-3 fatty acids,
- omega-6 fatty acids,
- citrate,
- pyruvate,
- alanine,
- 35 - glutamine,
- histidine,
- leucine,
- phenylalanine,
- valine; and

comparing the quantitative value(s) of the at least one biomarker to a control sample or to a control value;

wherein an increase or a decrease in the quantitative value(s) of the at least one biomarker, when compared to the control sample or to the control value, is/are indicative of the subject having an increased risk of developing the metabolic condition related to the fluid balance of the blood;

wherein the at least one biomarker comprises or is glycoprotein acetyls.

26. The method according to claim 25, wherein the method comprises determining in the biological sample quantitative values of a plurality of the biomarkers, such as two, three, four, five or more of the biomarkers.

27. The method according to any one of claims 25 - 26, wherein the method comprises determining in the biological sample obtained from the subject a quantitative value of the following biomarkers:

- glycoprotein acetyls;
- albumin; and

comparing the quantitative value(s) of the biomarkers to a control sample or to a control value(s);

wherein an increase or a decrease in the quantitative value(s) of the biomarkers, when compared to the control sample or to the control value, is/are indicative of the subject having an increased risk of developing the metabolic condition related to the fluid balance of the blood.

28. The method according to any one of claims 25 - 27, wherein the method comprises determining in the biological sample obtained from the subject a quantitative value of the following biomarkers:

- glycoprotein acetyls,
- at least one fatty acid measure(s) of the following: ratio of docosahexaenoic acid to total fatty acids, docosahexaenoic acid, ratio of linoleic acid to total fatty acids, linoleic acid, ratio of monounsaturated fatty acids and/or of oleic acid to total fatty acids, ratio of omega-3 fatty acids to total fatty acids, omega-3 fatty acids, ratio of omega-6 fatty acids to total fatty acids, omega-6 fatty acids, fatty acid degree of unsaturation; and

comparing the quantitative value(s) of the biomarkers to a control sample or to a control value(s);

wherein an increase or a decrease in the quantitative value(s) of the biomarkers, when compared to the control sample or
 5 to the control value, is/are indicative of the subject having an increased risk of developing the metabolic condition related to the fluid balance of the blood.

29. The method according to any one of claims 25 - 28, wherein the metabolic condition related to the fluid balance of
 10 the blood comprises or is volume depletion (E86); or other disorder of fluid, electrolyte and acid-base balance (E87).

30. The method according to any one of claims 25 - 29, wherein the metabolic condition related to the fluid balance of the blood comprises or is hyperosmolality and/or hyponatremia
 15 (E87.0); hypo-osmolality and/or hyponatremia (E87.1); acidosis (E87.2); hyperkalemia (E87.5); and/or hypokalemia (E87.6).

31. The method according to any one of claims 25 - 30, wherein the metabolic condition related to the fluid balance of the blood comprises or is volume depletion, or other disorder of
 20 fluid, electrolyte and/or acid-base balance.

32. The method according to any one of claims 25 - 31, wherein the quantitative value of the at least one biomarker is/are measured using nuclear magnetic resonance spectroscopy.

33. The method according to any one of claims 25 - 32, wherein the method further comprises determining whether the
 25 subject is at risk of developing the metabolic condition related to the fluid balance of the blood using a risk score, hazard ratio, odds ratio, and/or predicted absolute risk or relative risk calculated on the basis of the quantitative value(s) of the at
 30 least one biomarker or of the plurality of the biomarkers.

34. The method according to any one of claims 25 - 33, wherein the method comprises determining in the biological sample obtained from the subject a quantitative value of the following biomarkers:

- 35
- glycoprotein acetyls,
 - albumin,
 - ratio of docosahexaenoic acid to total fatty acids,
 - ratio of linoleic acid to total fatty acids,

- ratio of monounsaturated fatty acids and/or of oleic acid to total fatty acids,
- ratio of omega-3 fatty acids to total fatty acids,
- ratio of omega-6 fatty acids to total fatty acids,
- fatty acid degree of unsaturation,
- docosahexaenoic acid,
- linoleic acid,
- omega-3 fatty acids,
- omega-6 fatty acids,
- citrate,
- pyruvate,
- alanine,
- glutamine,
- histidine,
- leucine,
- phenylalanine, and
- valine; and

comparing the quantitative value(s) of the biomarkers to a control sample or to a control value(s);

wherein an increase or a decrease in the quantitative value(s) of the biomarkers, when compared to the control sample or to the control value, is/are indicative of the subject having an increased risk of developing the metabolic condition related to the fluid balance of the blood.