The invention claimed is:

1. A method of patterned data analysis for monitoring individual metabolic response and for generating predictive clinical metrics on HATR-FTIR spectroscopy by determining spectral characteristics of glucemic variability for healthy, prediabetic, and diabetic subjects, comprising of:

(i) assigning glucose-specific peaks with characteristic absorption wave numbers at 1030 cm −1 , 1041 cm −1 , 1080 cm −1, 1118 cm −1, and 1153 cm −1 in the 700-4000 cm −1 region in gathered HATR-FTR spectra from the forearm of a tested subject under post-prandial glucose test or oral glucose tolerance test with different doses at 5 g, 20 g, and 75 g, wherein oral glucose tolerance test is abbreviated OGTT, wherein spectrally assigned glucose-specific peaks at 1030 cm −1 and 1041 cm −1 are always bounded together bands;

(ii) determining spectral characteristics of glucemic variability for each assigned glucose-specific peak in correlation with the peak position and its shift to the left or to the right in HATR-FTIR spectra, wherein glucemic variability is abbreviated GV, wherein shifts of the peak position at 1030-1041 cm −1, 1118 cm −1, and 1153 cm −1 are characteristic for healthy, prediabetic, and diabetic subjects under post-prandial glucose test or OGTT with different doses at 5 g, 20 g, and 75 g;

(iii) determining spectral characteristics of GV for each assigned glucose-specific peak in correlation with the peak level in HATR-FTIR spectra, wherein determination of the highest peak level at 1030-1041 cm −1 and determination of the highest peak level among all assigned glucose-specific peaks is characteristic for healthy, prediabetic, and diabetic subjects under post-prandial glucose test or OGTT with different doses at 5 g, 20 g, and 75 g;

(iv) determining spectral characteristics of GV for each assigned glucose-specific peak in correlation with dose-dependent dynamic changes of the peak level under a continuous 120-minute test monitoring at pre-determined time-intervals from the starting till the ending time-points under comparative OGTT test with 5 g, 20 g, and 75 g glucose, wherein the levels of the peaks at 1030-1041 cm −1 , 1080 cm −1 , 1118 cm −1 , and 1153 cm −1 are independent to intaken dose of glucose under OGTT at 5 g, 20 g, and 75 g in healthy subjects, and wherein levels of the peaks at 1030-1041 cm −1 , 1080 cm −1 , 1118 cm −1 , and 1153 cm −1 are dependent to intaken dose of glucose under OGTT at 5 g, 20 g, and 75 g in prediabetic and diabetic subjects; and

(v) recognizing the spectral pattern of individual metabolic response by a continuous monitoring of GV, to be specific for healthy, prediabetic, and diabetic subjects, wherein

the spectral pattern with predominant left-shifted mean peak position towards 1030 cm −1 at 1030-1041 cm −1 , predominant left-shifted mean peak position towards 1116-1118 cm −1 at 1118 cm −1 , predominant left-shifted mean peak position towards 1149-1153 cm −1 at 1153 cm −1 , highest glucose peak levels at 1030-1041 cm −1 over for peaks levels at 1080 cm −1 , 1118 cm −1 , and 1153 cm −1 , lowest glucose peak levels at 1153 cm −1 below peaks levels at 1030-1041 cm −1 , 1080 cm −1 , and 1118 cm −1 , independent to intaken glucose dose peak levels at 1030-1041

cm −1 , 1080 cm −1 , 1118 cm −1 , and 1153 cm −1 under OGTT at 5 g, 20 g, and 75 g, wherein the dose at 5 g is low, the dose at 20 g is medium, and the dose at 75 g is high, to be specific for a healthy subject,

the spectral pattern with predominant right-shifted mean peak position towards 1037-1041 cm −1 at 1030-1041 cm −1 , predominant right-shifted mean peak position towards 1120-1122 cm −1 at 1118 cm −1 similarly high peak levels at 1030-1041 cm −1 , and at 1118 cm −1 over for peak levels at 1080 cm −1 and 1153 cm −1 , lowest glucose peak levels at 1153 cm −1 below peaks levels at 1030-1041 cm −1 , 1080 cm −1 , and 1118 cm −1 , dependent to intaken glucose dose peak levels at 1030-1041 cm −1 , 1080 cm −1 , and 1118 cm −1 under OGTT at 5 g, 20 g, and 75 g, to be specific for a prediabetic subject, and

the spectral pattern with dominant right-shifted mean peak position towards 1041 cm −1 at 1030-1041 cm −1 , dominant right-shifted mean peak position towards 1120-1122 cm −1 at 1118 cm −1 , dominant right-shifted mean peak position towards 1153-1157 cm −1 at 1153 cm −1 , highest glucose peak levels at 1118 cm −1 over for peak levels at 1030-1041 cm −1 1080 cm −1 , and 1153 cm −1 , lowest glucose peak levels at 1153 cm −1 below peaks levels at 1030-1041 cm −1 , 1080 cm −1 , and 1118 cm −1 , dependent to intaken glucose dose peak levels at 1030-1041 cm −1 , 1080 cm −1 , and 1118 cm −1 under OGTT at 5 g, 20 g, and 75 g, to be specific for a diabetic subject with type 2.

2. A method of patterned data analysis for monitoring individual metabolic response and for generating predictive clinical metrics on HATR-FTIR spectroscopy by determining spectral characteristics of the latency time for healthy, prediabetic, and diabetic subjects, comprising of:

(i) assigning glucose-specific peaks with characteristic absorption wave numbers at 1030 cm −1 , 1041 cm −1 , 1080 cm −1 , 1118 cm −1 , and 1153 cm −1 in the 700-4000 cm −1 region in gathered HATR-FTIR spectra from the forearm of a tested subject under post-prandial glucose test or OGTT with different doses at 5 g, 20 g, and 75 g, wherein spectrally assigned glucose-specific peaks at 1030 cm −1 and 1041 cm −1 are always bounded together bands;

(ii) calculating the latency time duration for each assigned glucose-specific peak at 1030-1041 cm −1 , 1080 cm −1 , 1118 cm −1 , and 1153 cm −1 , wherein latency time is abbreviated LT, wherein the LT is the time interval from the time-point of induction of glucose excursions till the time-point of maximum detected levels of the glucose-specific peaks at 1030-1041 cm −1 , 1080 cm −1 , 1118 cm −1 , and 1153 cm −1 on HATR-FTIR spectrometer in the interstitial fluid of skin tissue;

(iii) comparing calculated LT duration for each assigned glucose-specific peak at 1030-1041 cm −1 , 1080 cm −1 , 1118 cm −1 , and 1153 cm −1 in the interstitial fluid of skin tissue with the LT duration in capillary blood glucose gathered in the subject by calculating the LT differences, wherein capillary blood glucose is abbreviated CBG, wherein the LT is the time interval from the time-point

of induction of glucose excursions till the time-point of maximum detected levels of the CBG measurements in the subject in capillary blood glucose;

(iv) determining spectral characteristics for calculated LT and LT difference intervals for each assigned glucose-specific peak in correlation with their durations, wherein the shortest and the longest intervals in minutes to be specific for healthy, prediabetic, and diabetic subjects;

(v) determining spectral characteristics for calculated LT and LT difference intervals for each assigned glucose-specific peak in correlation with their phasic appearances, wherein single, bi-phasic, and cascading multi-phase appearance to be specific for healthy, prediabetic, and diabetic subjects;

(vi) determining spectral characteristics for calculated LT and LT difference intervals for each assigned glucose-specific peak in correlation with dose-dependency, to be specific for healthy, prediabetic, and diabetic subjects; and

(vii) determining the spectral pattern of individual metabolic response by calculating LT and LT difference intervals for each assigned glucose-specific peak under post-prandial glucose test and OGTT with different doses at 5 g, 20 g, and 75 g, to be specific for healthy, prediabetic, and diabetic subjects, wherein

the spectral pattern characterized by

bi-phase LTs and LT differences at 1030-1041 cm −1 of 15 min and 30 min under OGTT at 5 g,

single-phase LTs and LT differences at 1030-1041 cm −1 of 10 min under OGTT at 20 g,

bi-phase LTs and LT differences at 1030-1041 cm −1 of 5 min and 30 min under OGTT at 75 g,

bi-phase LTs and LT differences at 1080 cm −1 of 15 min and 30 min under OGTT at 5 g, cascading multi-phase LTs and LT differences at 1080 cm −1 of 0 min, 10 min, and 20 min under OGTT at 20 g,

single-phase LTs and LT differences at 1080 cm −1 of 5 min under OGTT at 75 g,

bi-phase LTs and LT differences at 1118 cm −1 s of 10 min and 25 min under OGTT at 5 g,

single-phase LT and LT difference at 1118 cm −1 of 10 min under OGTT at 20 g,

bi-phase LTs and LT differences at 1118 cm −1 of 5 min and 25 min under OGTT at 75 g,

bi-phase LTs and LT differences at 1153 cm −1 of 35 min and 50 min under OGTT at 5 g,

single-phase LT and LT difference at 1153 cm −1 of 10 min and 15 min under OGTT at 20 g,

single-phase LT and LT difference at 1153 cm −1 of 30 min under OGTT at 75 g,

the longest durations of LT differences of

5 min and 30 min for dose 75 g, 10 min for dose 20 g, and 15 min and 30 min for dose 5 g at 1030-1041 cm −1 ,

5 min for dose 75 g, 0 min and 10 min, and 20 min for dose 20 g, and 15 min and 30 min for dose 5 g at 1080 cm −1 ,

5 min and 25 min for dose 75 g, 10 min for dose 20 g, and 10 min and 25 min for dose 5 g at 1118 cm −1 ,

10 min for dose 75 g, 10 min and 15 min for dose 20 g, and 35 min and 50 min at 1153 cm −1

under OGTT with different doses,

dose-independent LTs and LT differences for each assigned glucose-specific peak under any OGTT with different doses of 5 g, 20 g or 75 g,

bi-phase LTs with LT differences of 15 min and 30 min at 1030-1041 cm −1 , 15 min and 30 min at 1080 cm −1 , 10 min and 25 min at 1118 cm −1 , 35 min and 50 min at 1153 cm −1 under OGTT at 5 g,

single-, bi-phase, and cascading multi-phase LTs with LT differences of 10 min at 1030-1041 cm −1, 0 min and 10 min, and 20 min at 1080 cm −1, 10 min at 1118 cm −1, 10 min and 15 min at 1153 cm −1 under OGTT at 20 g,

single- and bi-phase LTs with LT differences of 5 min and 30 min at 1030-1041 cm −1, 5 min at 1080 cm −1, 5 min and 25 min at 1118 cm −1, 10 min at 1153 cm −1 under OGTT at 75 g,

the longest durations of LT differences of starting from 5 min-50 min with single-, bi-, or cascading multi-phase appearances at 1030-1041 cm −1 , 1080 cm −1 , 1118 cm −1 , and 1153 cm-under OGTT at 75 g in a healthy subject, as compared with the shortest durations of LT differences of starting from 0 min-30 min with single-phase appearances at 1030-1041 cm −1 , 1080 cm −1 , 1118 cm −1 , and 1153 cm −1 under OGTT at 75 g in a diabetic subject, and as compared with the shortest durations of LT differences of starting from 0 min-55 min with cascading multi-phase appearances at 1030-1041 cm −1 , 1080 cm −1 , 1118 cm −1 , and 1153 cm −1 under OGTT at 75 g in a prediabetic subject,

to be specific for a healthy subject,

the spectral pattern characterized by

cascading multi-phase LTs and LT differences at 1030-1041 cm −1 of 5 min, 20 min, 30 min and 45 min under OGTT at 75 g,

cascading multi-phase LTs and LT differences at 1080 cm −1 of 5 min, 20 min, and 45 min under OGT at 75 g,

cascading multi-phase LTs and LT differences at 1118 cm −1 of 5 min, 20 min, 30 min, and 40 min under OGTT at 75 g,

cascading multi-phase LTs and LT differences at 1153 cm −1 of 0 min, 15 min, 25 min, and 55 min under OGTT at 75 g,

cascading multi-phase LTs and LT differences of 5 min-45 min at 1030-1041 cm −1 , 5 min-45 min at 1080 cm −1 , 5 min-40 min at 1118 cm −1 , 0 min-55 min at 1153 cm −1 under OGTT at 75 g,

dose-independent LTs and LT differences with cascading multi-phase appearances at

5 min, 20 min, 30 min and 45 min at 1030-1041 cm −1 ,

5 min, 20 min and 45 min at 1080 cm −1 ,

5 min, 20 min, 30 min and 40 min at 1118 cm −1 ,

0 min, 15 min, 25 min and 55 min at 1153 cm −1

under OGTT at 75 g,

the shortest durations of LT differences of starting from 0 min with cascading multi-phase appearances at 1030-1041 cm −1 , 1080 cm −1 , 1118 cm −1 , and 1153 cm −1 under OGTT at 75 g, as compared with the shortest durations of LT differences of starting from 0 min with single-phase appearances at 1030-1041 cm −1 , 1080 cm −1 , 1118 cm −1 , and 1153 cm −1 under OGTT at 75 g in a diabetic subject, and as compared with the longest durations of LT differences of starting from 5 min with single-, bi- or cascading multi-phase appearances at 1030-1041 cm −1 , 1080 cm −1 , 1118 cm −1 , and 1153 cm −1 under OGTT at 75 g in a healthy subject,

to be specific for a prediabetic subject, and

the spectral pattern characterized by

bi-phase LTs and LT differences of 0 min and 10 min at 1030-1041 cm −1 under OGTT at 5 g,

single-phase LT and LT difference of 0 min at 1030-1041 cm −1 under OGTT at 20 g,

single-phase LT and LT difference of 0 min at 1030-1041 cm −1 under OGTT at 75 g,

single-phase LT and LT difference of 10 min at 1080 cm −1 under OGTT at 5 g,

single-phase LT and LT difference of 15 min at 1080 cm −1 under OGTT at 20 g,

single-phase LT and LT difference of 0 min at 1080 cm −1 under OGTT at 75 g,

cascading multi-phase LTs and LT differences of 0 min, 10 min and 25 min at 1118 cm −1 under OGTT at 5 g,

single-phase LT and LT difference of 5 min at 1118 cm −1 under OGTT at 20 g,

single-phase LT and LT difference of 0 min at 1118 cm −1 under OGTT at 75 g,

bi-phase LTs and LT differences of 15 min and 25 min under OGTT at 5 g,

bi-phase LTs and LT differences of 25 min and 40 min under OGTT at 20 g,

single-phase LT and LT differences of 30 min under OGTT at 75 g,

the shortest durations of LT differences of

0 min for dose 75 g, 0 min for dose 20 g, 0 min and 10 min for dose 5 g at 1030-1041 cm −1 ,

0 min for dose 75 g, 15 min for dose 20 g, 10 min for dose 5 g at 1080 cm −1 ,

0 min for dose 75 g, 5 min for dose 20 g, 0 min and 10 min and 25 min for dose 5 g at 1118 cm −1 ,

30 min for dose 75 g, 25 min and 40 min for dose 20 g, 15 min and 25 min at 1153 cm −1

under OGTT with different doses,

the shortest durations of LTs and LT differences of

0 min at 1030-1041 cm −1,

0 min, 0 min and 60 min, or 60 min at 1080 cm −1,

0 min or 0 min and 60 min at 1118 cm −1,

30 min and 60 min at 1153 cm −1

under post-prandial glucose test,

dose-dependent LTs and LT differences at 1030-1041 cm −1, 1080 cm −1, and 1118 cm-under any OGTT with different doses at 5 g, 20 g, and 75 g glucose,

single-, bi-phase, and cascading multi-phase LTs and LT differences of 0 min and 10 min at 1030-1041 cm −1 , 10′ at 1080 cm −1 , 0 min, 10 min and 25 min at 1118 cm −1 , 15 min and 25 min at 1153 cm −1under OGTT at 5 g,

single- and bi-phase LTs and LT differences of 0 min at 1030-1041 cm −1, 15′ at 1080 cm −1, 5′ at 1118 cm −1, 15′ and 40′ at 1153 cm −1 under OGTT at 20 g,

single-phase LT and LT differences of 0′ at 1030-1041 cm −1, 0′ at 1080 cm −1, 0′ at 1118 cm −1, 30′ at 1153 cm −1 under OGTT at 75 g,

the shortest durations of LT differences of starting from 0 min-30 min with single-phase appearances at 1030-1041 cm −1 , 1080 cm −1 , 1118 cm −1 , and 1153 cm −1 under OGTT at 75 g, as compared with the shortest durations of LT differences of starting from 0 min with cascading multi-phase appearances at 1030-1041 cm −1 , 1080 cm −1 , 1118 cm −1 , and 1153 cm −1 under OGTT at 75 g in a prediabetic subject, and as compared with the longest durations of LT differences of starting from 5 min with single-, bi- or cascading multi-phase appearances at 1030-1041 cm −1, 1080 cm −1 , 1118 cm −1 , and 1153 cm −1 under OGTT at 75 g in a healthy subject,

to be specific for a diabetic subject with type 2.

3. The method of claim 1, for monitoring the change of the spectral pattern of individual metabolic response and generated predictive clinical metrics on HATR-FTIR spectroscopy for healthy, prediabetic, and diabetic subjects under post-prandial glucose test or OGTT with different doses at 5 g, 20 g, and 75 g.

claim 1

4. The method of claim 1, for diagnosing disorders of glucose metabolism including prediabetes and diabetes in a subject, or for screening and follow-up a development of a diabetes in a healthy subject, or for screening and follow-up a development of a diabetes in a subject with a prediabetes, or for predicting the subject's risk of hyperglycemia, or for staging type 2 diabetes in a subject, or for managing a subject with or without hyperglycemia, or for assessing the quality of metabolic control in a subject, or for determining an effective therapy in a subject with a type 2 diabetes, or for determining an effective dosage of drug in a subject with a type 2 diabetes, or for stratifying a subject to a therapeutic regimen for treating or preventing a diabetes by determining prognosis of the treatment in prediabetic and diabetic subject.

claim 1

5. FTIR spectrometer when used in a method for diagnosing disorders of glucose metabolism including prediabetes and diabetes in a subject, or for screening and follow-up a development of a

diabetes in a healthy subject, or for screening and follow-up a development of a diabetes in a subject with a prediabetes, or for predicting the subject's risk of hyperglycemia, or for staging type 2 diabetes in a subject, or for managing a subject with or without hyperglycemia, or for assessing the quality of metabolic control in a subject, or for determining an effective therapy in a subject with a type 2 diabetes, or for determining an effective dosage of drug in a subject with a type 2 diabetes, or for stratifying a subject to a therapeutic regimen for treating or preventing a diabetes by determining prognosis of the treatment in prediabetic and diabetic subject, comprising the steps according to claim 1.

claim 1

6. A method for in vivo glucose molecule characterization at 1030 cm −1 or 1041 cm −1 , characterized by spectral bounded bands within 1030-1041 cm −1 in HATR-FTIR spectra corresponding to identity and structures to glucose molecules in correlation with characteristic measurements of the peak position and its shift, the peak levels measured in the interstitial fluid of the epidermal skin tissue of a healthy, prediabetic or diabetic subject under post-prandial glucose test or OGTT with different doses at 5 g, 20 g, and 75 g by HATR-FTIR spectroscopy, comprising:

characterizing a glucose molecule in HATR-FTIR spectra by

predominant mean peak position at 1037-1041 cm −1 within 1030-1041 cm −1 ,

the highest glucose peak levels within 1030-1041 cm −1 similar to the peak levels at 1118 cm −1 in HATR-FTIR spectra,

dose-dependent peak levels to high doses of glucose under OGTT at 75 g,

cascading multi-phase LTs and LT differences of 5 min, 20 min, 30 min, and 45 min under OGTT at 75 g,

to be specific for a prediabetic subject; and

(i) characterizing a glucose molecule in HATR-FTIR spectra by

predominant mean peak position at 1030 cm −1 within 1030-1041 cm −1 ,

the highest glucose peak levels within 1030-1041 cm −1 over the other glucose peaks levels at 1080 cm −1 , 1118 cm −1 , and 1153 cm −1 ,

independent to low, medium, and high glucose doses peak levels under OGTT with 5 g, 20 g, and 75 g,

bi-phase LTs and LT differences of 15 min and 30 min under OGTT at 5 g,

single-phase LTs and LT differences of 10 min under OGTT at 20 g,

bi-phase LTs and LT differences of 5 min and 30 min under OGTT at 75 g,

to be specific for a healthy subject; or

(ii) characterizing a glucose molecule in HATR-FTIR spectra by

predominant mean peak position at 1039-1041 cm −1 within 1030-1041 cm −1 in HATR-FTIR spectra,

dose-dependent to low, medium, and high glucose doses peak levels under OGTT with 5 g, 20 g, and 75 g,

single-phase LT and LT difference of 0 min under post-prandial glucose test,

bi-phase LTs and LT differences of 0 min and 10 min under OGTT at 5 g,

single-phase LT and LT difference of 0 min under OGTT at 20 g,

single-phase LT and LT difference of 0 min under OGT at 75 g,

to be specific for a diabetic subject.

7. A method for in vivo glucose molecule characterization at 1080 cm −1 , characterized by spectral bounded bands at 1080 cm −1 in HATR-FTIR spectra corresponding to identity and structures to glucose molecules in correlation with characteristic measurements of the peak position and its shift, the peak levels measured in the interstitial fluid of the epidermal skin tissue of a healthy, prediabetic or diabetic subject under post-prandial glucose test or OGTT with different doses at 5 g, 20 g, and 75 g by HATR-FTIR spectroscopy, comprising:

characterizing a glucose molecule in HATR-FTIR spectra by dose-dependent peak levels to high glucose dose under OGTT with 75 g,

cascading multi-phase LTs and LT differences of 5 min, 20 min, and 45 min under OGTT at 75 g,

to be specific for a prediabetic subject; and

(i) characterizing a glucose molecule in HATR-FTIR spectra by

dose-independent peak levels to low, medium, and high glucose doses under OGTT with 5 g, 20 g, and 75 g,

bi-phase LTs and LT differences of 15 min and 30 min under OGTT at 5 g,

cascading multi-phase LTs and LTs differences of 0 min, 10 min, and 20 min under OGTT at 20 g,

single-phase LT and LT difference of 5 min under OGTT at 75 g, to be specific for a healthy subject; or

(ii) characterizing a glucose molecule in HATR-FTIR spectra by

dose-dependent peak levels to low, medium, and high glucose doses under OGTT with 5 g, 20 g, and 75 g,

single-phase LT and LT difference of 10 min under OGTT at 5 g,

single-phase LT and LT difference of 15 min under OGTT at 20 g,

single-phase LT and LT difference of 0 min under OGTT at 75 g,

to be specific for a diabetic subject.

8. A method for in vivo glucose molecule characterization at 1118 cm −1 , characterized by spectral bounded bands at 1118 cm −1 in HATR-FTIR spectra corresponding to identity and structures to glucose molecules in correlation with characteristic measurements of the peak position and its shift, the peak levels measured in the interstitial fluid of the epidermal skin tissue of a healthy, prediabetic or diabetic subject under post-prandial glucose test or OGTT with different doses at 5 g, 20 g, and 75 g by HATR-FTIR spectroscopy, comprising:

characterizing a glucose molecule in HATR-FTIR spectra by

predominant right-shifted mean peak position within 1120-1122 cm −1 ,

the highest glucose peak levels similar to glucose peak levels at 1030-1041 cm −1 over the other 2 glucose peak levels at 1080 cm −1 and 1153 cm −1 ,

dose-independent peak levels to high dose of glucose at 75 a under OGTT at 75 g,

cascading multi-phase LT's and LT differences with the time intervals of 5 min, 20 min, 30 min and 40 min under OGTT at 75 g,

to be specific for a prediabetic subject; and

(i) characterizing a glucose molecule in HATR-FTIR spectra by

predominant left-shifted mean peak position within 1114-1118 cm −1 , wherein mean peak position at 1118 cm −1 is characteristic under OGTT at 5 g, mean peak position at 1114-1118 cm −1 is

characteristic under OGTT at 20 g, mean peak position at 1116-1118 cm −1 is characteristic under OGTT at 75 g,

dose-independent peak levels to low, medium, and high glucose doses under OGTT with 5 g, 20 g, and 75 g,

bi-phase LTs and LT differences of 10 min and 25 min under OGTT at 5 g,

single-phase LT and LT difference of 10 min under OGTT at 20 g,

bi-phase LT's and LT differences of 5 min and 25 min under OGTT at 75 g, to be specific for a healthy subject; or

(ii) characterizing a glucose molecule in HATR-FTIR spectra by

dominant right-shifted mean peak position at 1120-1122 cm −1 ,

the highest glucose peak levels within 1120-1122 cm −1 over glucose peaks levels at 1030-1041 cm −1 , 1080 cm −1 , and 1153 cm −1 in HATR-FTIR spectra,

dose-dependent peak levels to low, medium, and high doses of glucose at 5 g, 20 g, and 75 g under OGTT at 5 g, 20 g, and 75 g,

three-phase LT's and LT differences of 0 min, 10 min and 25 min under OGTT at 5 g,

single-phase LTs and LT differences of 5 min under OGTT at 20 g,

single-phase LT and LT differences of 0 min under OGTT at 75 g,

to be specific for a diabetic subject.

9. A method for in vivo glucose molecule characterization at 1153 cm −1 , characterized by spectral bounded bands at 1153 cm −1 in HATR-FTIR spectra corresponding to identity and structures to glucose molecules in correlation with characteristic measurements of the peak position and its shift, the peak levels measured in the interstitial fluid of the epidermal skin tissue of a healthy, prediabetic or diabetic subject under post-prandial glucose test or OGTT with different doses at 5 g, 20 g, and 75 g by HATR-FTIR spectroscopy, comprising:

characterizing a glucose molecule in HATR-FTIR spectra by

the lowest glucose peak levels within 1153 cm −1 below glucose peak levels at 1030-1041 cm −1 , 1080 cm −1 , and 1118 cm −1 ,

cascading LT's and LT differences of 0 min, 15 min, 25 min and 55 min under OGTT at 75 g,

to be specific for a prediabetic subject; and

(i) characterizing a glucose molecule in HATR-FTIR spectra by

predominant left-shifted mean peak position within 1149-1153 cm −1 ,

the lowest glucose peak levels within 1153 cm −1 below glucose peaks levels at 1030-1041 cm −1 , 1080 cm −1 and 1118 cm −1 ,

bi-phase LTs and LT differences of 35 min and 50 min under OGTT at 5 g,

bi-phase LTs and LT differences with the time intervals of 10 min and 15 min under OGTT at 20 g,

single-phase LT and LT difference of 10 min under OGTT at 75 g,

to be specific for a healthy subject; or

(ii) characterizing a glucose molecule in HATR-FTIR spectra by

predominant right-shifted mean peak position within 1153-1157 cm −1 ,

the lowest glucose peak levels within 1153 cm −1 below glucose peak levels at 1030-1041 cm −1 , 1080 cm −1 , and 1118 cm −1 ,

bi-phase LTs and LT differences of 15 min and 25 min under OGTT at 5 g,

bi-phase LTs and LT differences of 25 min and 40 min under OGTT at 20 g,

single-phase LT and LT difference of 30 min under OGT at 75 g,

to be specific for a diabetic subject.

10. A method for in vivo glucose molecule characterization of a combination group of glucose molecules with characteristic spectral parameters at consistent and significant absorption wave number at 1030 cm −1 , 1041 cm −1 , 1080 cm −1 , 1118 cm −1 , and 1153 cm −1 , characterized by spectral bounded bands at 1030-1041 cm −1 1080 cm −1 , 1118 cm −1 , and 1153 cm −1 in HATR-FTIR spectra corresponding to identity and structures to glucose molecules in correlation with characteristic measurements of the peak position and its shift, the peak levels measured in the interstitial fluid of the epidermal skin tissue of a healthy, prediabetic or diabetic subject under post-prandial glucose test or OGTT with different doses at 5 g, 20 g, and 75 g by HATR-FTIR spectroscopy, comprising:

characterizing a combination group of glucose molecules in HATR-FTIR spectra by

cascading multi-phase LTs and LT differences at 1030-1041 cm −1 of 5 min, 20 min, 30 min, and 45 min under OGTT at 75 g,

cascading multi-phase LTs and LT differences at 1080 cm −1 of 5 min, 20 min, and 45 min under OGTT at 75 g,

cascading multi-phase LTs and LT differences at 1118 cm −1 of 5 min, 20 min, 30 min, and 40 min under OGTT at 75 g,

cascading multi-phase LTs and LT differences at 1153 cm −1 of 0 min, 15 min, 25 min, and 55 min under OGT at 75 g,

cascading multi-phase LTs and LT differences of 5 min-45 min at 1030-1041 cm −1 , 5 min-45 min at 1080 cm −1 , 5 min-40 min at 1118 cm −1 , 0 min-55 min at 1153 cm −1 under OGT at 75 g,

dose-independent LTs and LT differences with cascading multi-phase appearances at

5 min, 20 min, 30 min and 45 min at 1030-1041 cm −1 ,

5 min, 20 min and 45 min at 1080 cm −1 ,

5 min, 20 min, 30 min and 40 min at 1118 cm −1 ,

0 min, 15 min, 25 min and 55 min at 1153 cm −1

under OGT at 75 g,

the shortest durations of LT differences of starting from 0 min with cascading multi-phase appearances at 1030-1041 cm −1 , 1080 cm −1 , 1118 cm −1 , and 1153 cm −1 under OGTT at 75 g, as compared with the shortest durations of LT differences starting from 0 min with singe-phase appearances at 1030-1041 cm −1 , 1080 cm −1 , 1118 cm −1 , and 1153 cm −1 under OGTT at 75 g in a diabetic subject, and as compared with the longest durations of LT differences starting from 5 min with single-, bi- or cascading multi-phase appearances at 1030-1041 cm −1 , 1080 cm −1 , 1118 cm −1 , and 1153 cm −1 under OGTT at 75 g in a healthy subject,

to be specific for a prediabetic subject; and

(i) characterizing a combination group of glucose molecules in HATR-FTIR spectra by

bi-phase LTs and LT differences at 1030-1041 cm −1 of 15 min and 30 min under OGTT at 5 g,

single-phase LTs and LT differences at 1030-1041 cm −1 of 10 min under OGTT at 20 g,

bi-phase LTs and LT differences with CBG at 1030-1041 cm −1 of 5 min and 30 min under OGTT at 75 g,

bi-phase LTs and LT differences at 1080 cm −1 of 15 min and 30 min under OGTT at 5 g,

three-phase LTs and LT differences at 1080 cm −1 of 0 mm, 10 min, and 20 min under OGTT at 20 g,

single-phase LTs and LT differences with CBG at 1080 cm −1 of 5 mi under OGTT at 75 g,

bi-phase LTs and LT differences at 1118 cm −1 of 10 min and 25 min under OGTT at 5 g,

single-phase LT and LT difference at 1118 cm −1 of 10 min under OGTT at 20 g,

bi-phase LTs and LT differences at 1118 cm −1 of 5 min and 25 min under OGTT at 75 g,

bi-phase LTs and LT differences at 1153 cm −1 of 35 min and 50 min under OGTT at 5 g,

single-phase LT and LT difference at 1153 cm −1 of 10 min and 15 min under OGTT at 20 g,

single-phase LT and LT difference at 1153 cm −1 of 30 min under OGTT at 75 g,

the longest durations of LT differences of

5 min and 30 mm for dose 75 g, 10 mm for dose 20 g and 15 min, and 30 min for dose 5 g at 1030-1041 cm −1 ,

5 min for dose 75 g, 0 min and 10 min and 20 min for dose 20 g and 15 min, and 30 min for dose 5 g at 1080 cm −1 ,

5 min and 25 min for dose 75 g, 10 min for dose 20 g and 10 min, and 25 min for dose 5 g at 1118 cm −1 ,

10 min for dose 75 g, 10 min and 15 min for dose 20 g, and 35 min and 50 min for dose 5 g at 1153 cm −1

under OGT with different doses,

dose-independent LTs and LT differences for each assigned glucose-specific peak under any OGTT with different doses of 5 g, 20 g or 75 g,

bi-phase LTs with LT differences of 15 min and 30 min at 1030-1041 cm −1 , 15 min and 30 min at 1080 cm −1 , 10 min and 25 min at 1118 cm −1 , 35 min and 50 min at 1153 cm −1 under OGTT at 5 g,

single-, bi-phase, and cascading multi-phase LTs with LT differences of 10 min at 1030-1041 cm −1 , 0 min and 10 min, and 20 min at 1080 cm −1 , 10 min at 1118 cm −1 , 10 min and 15 min at 1153 cm −1 under OGTT at 20 g,

single- and bi-phase LTs with LT differences of 5 min and 30 min at 1030-1041 cm −1 , 5 min at 1080 cm −1 , 5 min and 25 min at 1118 cm −1 , 10 min at 1153 cm −1 under OGTT at 75 g,

the longest durations of LT differences starting from 5 min with single-, bi- or cascading multi-phase appearances at 1030-1041 cm −1 , 1080 cm −1 , 1118 cm −1 , and 1153 cm −1 under OGTT at 75 g in a healthy subject, Table 4 (column 2) or Table 7 (column 2), as compared with the shortest durations of LT differences starting from 0 min with single-phase appearances at 1030-1041 cm −1 , 1080 cm −1 , 1118 cm −1 , and 1153 cm −1 under OGTT at 75 g in a diabetic subject, and as compared with the shortest durations of LT differences of starting from 0 min with cascading multi-phase appearances at 1030-1041 cm −1 , 1080 cm −1 , 1118 cm −1 , and 1153 cm −1 under OGTT at 75 g in a prediabetic subject,

to be specific for a healthy subject, or

(ii) characterizing a combination group of glucose molecules in HATR-FTIR spectra by

bi-phase LTs and LT differences of 0 min and 10 min at 1030-1041 cm −1 under OGTT at 5 g,

single-phase LT and LT difference of 0 min at 1030-1041 cm −1 under OGTT at 20 g,

single-phase LT and LT difference of 0 min at 1030-1041 cm −1 under OGT at 75 g,

single-phase LT and LT difference of 10 min at 1080 cm −1 under OGTT at 5 g,

single-phase LT and LT difference of 15 min at 1080 cm −1 under OGTT at 20 g,

single-phase LT and LT difference of 0 min at 1080 cm −1 under OGTT at 75 g,

cascading multi-phase LTs and LT differences of 0 min, 10 min and 25 min at 1118 cm −1 under OGTT at 5 g,

single-phase LT and LT difference of 5 min at 1118 cm −1 under OGTT at 20 g,

single-phase LT and LT difference of 0 min at 1118 cm −1 under OGTT at 75 g,

bi-phase LTs and LT differences of 15 min and 25 min under OGTT at 5 g,

bi-phase LTs and LT differences of 25 min and 40 min under OGTT at 20 g,

single-phase LT and LT differences of 30 min under OGTT at 75 g,

the shortest durations of LT differences of

0 min for dose 75 g, 0 min for dose 20 g, 0 min and 10 min for dose 5 g at 1030-1041 cm −1 ,

0 min for dose 75 g, 15 min for dose 20 g, 10 min for dose 5 g at 1080 cm −1 ,

0 min for dose 75 g, 5 min for dose 20 g, 0 min, and 10 min, and 25 min for dose 5 g at 1118 cm −1 ,

30 min for dose 75 g, 25 min and 40 min for dose 20 g, and 15 min and 25 min at 1153 cm −1

under OGTT with different doses,

the shortest durations of LTs and LT differences of

0 min at 1030-1041 cm −1 ,

0 min, 0 min and 60 min or 60 min at 1080 cm −1 ,

0 min or 0 min and 60 min at 1118 cm −1 ,

30 min and 60 min at 1153 cm −1

under post-prandial glucose test,

dose-dependent LTs and LT differences at 1030-1041 cm −1 , 1080 cm −1 and 1118 cm −1 under any OGTT with different doses at 5 g, 20 g, and 75 g glucose,

single-, bi-phase, and cascading multi-phase LTs and LT differences of 0 min and 10 min at 1030-1041 cm −1 , 10′ at 1080 cm −1 , 0 min, 10 min and 25 min at 1118 cm −1 , 15 min and 25 min at 1153 cm −1 under OGTT at 5 g,

single- and bi-phase LTs and LT differences of 0 min at 1030-1041 cu, 15′ at 1080 cm −1 , 5′ at 1118 cm −1 , 15′ and 40′ at 1153 cm −1 under OGTT at 20 g,

single-phase LT and LT differences of 0′ at 1030-1041 cm −1 , 0′ at 1080 cm −1 , 0′ at 1118 cm −1 , 30′ at 1153 cm −1 under OGTT at 75 g,

the shortest durations of LT differences starting from 0 min with single-phase appearances at 1030-1041 cm −1 , 1080 cm −1 , 1118 cm −1 , and 1153 cm −1 under OGTT at 75 g, as compared with the shortest durations of LT differences starting from 0 min with cascading multi-phase appearances at 1030-1041 cm −1 , 1080 cm −1 , 1118 cm −1 , and 1153 cm −1 under OGT at 75 g in a prediabetic subject, and as compared with the longest durations of LT differences starting

from 5 min with single-, bi- or cascading multi-phase appearances at 1030-1041 cm −1 , 1080 cm −1 , 1118 cm −1 , and 1153 cm −1 under OGT at 75 g in a healthy subject,

to be specific for a diabetic subject with type 2.

11. The method of any of claim 6 diagnosing disorders of glucose metabolism including prediabetes and diabetes in a subject, or for screening and follow-up a development of a diabetes in a healthy subject, or for screening and follow-up a development of a diabetes in a subject with a prediabetes, or for predicting the subject's risk of hyperglycemia, or for staging type 2 diabetes in a subject, or for managing a subject with or without hyperglycemia, or for assessing the quality of metabolic control in a subject, or for determining an effective therapy in a subject with a type 2 diabetes, or for determining an effective dosage of drug in a subject with a type 2 diabetes, or for stratifying a subject to a therapeutic regimen for treating or preventing a diabetes by determining prognosis of the treatment in prediabetic and diabetic subject.

claim 6

12. The method of any of claim 6, wherein LT is the time interval from the time-point of induction of glucose excursions till the time-point of maximum detected levels of the glucose-specific peaks at 1030-1041 cm −1 , 1080 cm −1 , 1118 cm −1 , and 1153 cm −1 on HATR-FTIR spectrometer in the interstitial fluid of skin tissue in gathered HATR-FTIR spectra from the forearm of a tested subject under post-prandial glucose test or OGTT with different doses at 5 g, 20 g, and 75 g.

claim 6