Weather Characteristics

The average air temperature across the country during the first part of September was +9.9 °C, with a monthly maximum of +19.2 °C and a minimum of –1.5 °C. Total precipitation for the first part of September was 5.8 mm, 74% below the decade norm of 22.6 mm. September's total rainfall was 39.0 mm, the driest since 2018 and the driest autumn since then. The average relative humidity in the first part of September was 76%, with the Northwest Coastal region at 67%, and the East Coastal region at 82%. Areas with the least precipitation included Smiltene 6NE (56.7 mm), Tukums 2WN (59.0 mm) and Jelgava 3S (60.3 mm), while Cesis 5NE (61.0 mm), Ventspils 1NW (64.6 mm), and Sigulda 4EN (66.4 mm) received the most. Along the Gulf of Riga coast (**2WN**, **3S**, **4EN**) and in the western region of the country (**1NW**), sunshine duration in September was up to 50% longer than the 1991–2020 average, while in the north-east (**5NE**, **6NE**), sunshine was up to 50% lower than usual. The average hourly value of ultraviolet light radiation in the first ten days of September was 0.15 W/m^2 (06:00–09:00), 0.50 W/m^2 (10:00–14:00) and 0.08 W/m^2 (15:00–17:00). In September, the average air temperature in Latvia was mostly below normal, with values of 13.2 °C for 1NW, 12.4 °C for 2WN, 12.6 °C for 3S, 12.3 °C for 4EN, 11.5 °C for 5NE, and 11.6 °C for 6NE (SLLC LEGMC).

State Limited Liability Company "Latvian Environment, Geology and Meteorology Centre" (SLLC LEGMC), https://videscentrs.lvgmc.lv/lapas/sllc-latvian-environment-geology-and-meteorology-centre [accessed 10 August 2025]. Available from: https://data.gov.lv/dati/dataset/klimatiskie-dati/resource/fa97540f-dcee-425d-93b4-b49af7e71cc5.
https://klimats.meteo.lv/operativais_klimats/laikapstaklu_apskati/2022/septembris/

Water-soluble Vitamins B and Vitamin C MRM Mode Parameters

Ultra-performance liquid chromatography (ULPC), coupled with UV and mass spectrometric (MS) detection, was used to analyse water-soluble vitamins. The MS conditions for water-soluble vitamins, including the multiple reaction monitoring (MRM) acquisition mode and monitored ion transitions, were set according to Waters™ application notes. The UPLC conditions involved an Acquity™ UPLC HSS T3 C18 column (1.8 µm, 2.1 mm × 150 mm) maintained at 40.0°C, with a solvent system of 10 mM ammonium formate in 0.1% formic acid (A) and 10 mM ammonium formate in methanol with 1% formic acid (B). An autosampler was used to keep samples at 4°C and inject 2.0 µL into the loop. The mobile phase was applied in gradient elution mode: 0-1 min at 1–8% B; 1–4 min at 8–35% B; 4–10 min at 35% B; followed by a return to the initial condition within 5 minutes, with a total flow rate of 0.25 mL/min.

Table S1. UPLC-MS parameters of water-soluble B and C vitamins, which include retention time (RT), multiple reaction monitoring (MRM) transitions, cone voltages, and collision energy values.

Vitamin compounds	RT, min	MRM transition	Cone voltage, V	Collision energy, eV
Riboflavin (B2)	8.7	377.0 > 243.0	42	22
Calcium pantothenate (B5)	6.4	242.0 > 153.0	30	15
Ascorbic acid (C)	1.2	177.0 > 141.0	24	8
Niacin (B3)	2.4	124.0 > 80.0	38	20
Nicotinamide (B3´)	5.1	123.0 > 80.0	40	20

Table S2. Results of calibration of B, C vitamins according to established MS conditions.

Vitamin compounds	Linearity range, µg/mL	R^2	Slope	Intercept
Riboflavin (B2)	0.007 – 0.370	0.9958	10293	161
Calcium pantothenate (B5)	0.045 – 1.800	0.9994	84702	824
Ascorbic acid (C)	0.500 – 1.800	0.9991	628	-264
Niacin (B3)	0.009 – 4.500	0.9993	56575	89
Nicotinamide (B3´)	0.009 – 4.500	0.9989	55928	357

Fatty Acids Profile

Table S3. Mean concentrations (mg/100 g dry weight (SD) of fatty acids in the studied *Cantharellus cibarius* collected from various sites

Fatty acids	1NW	2WN	3S	4EN	5NE	6NE
12:0	0.25±0.05^{a}	0.10±0.02^{a}	0.45±0.02^{a}	0.42±0.11^{a}	0.76±0.03^{a}	0.45±0.05^{a}
14:0	2.26±0.12^{cd}	1.89±0.12^{d}	4.24±0.20^{d}	3.63±0.15^{ab}	4.34±0.10^{a}	3.13±0.28^{bc}
15:0	2.94±0.21^{ab}	1.76±0.14^{b}	5.86±0.57^{a}	4.03±0.10^{ab}	4.99±0.05^{a}	4.52±0.15^{a}
i 15:0	1.27±0.02^{bc}	0.71±0.07^{c}	2.48±0.29^{a}	1.09±0.08^{b}	2.28±0.46^{b}	2.46±0.26^{a}
ai 15:0	0.93±0.10^{cd}	0.51±0.04^{e}	1.95+0.09^{bc}	0.98±0.06^{b}	1.07±0.02^{a}	2.03±0.11^{ab}
AZA	2.51±0.07^{cd}	<0.01	3.07±0.22^{bc}	2.05±0.08^{d}	4.59±0.22^{a}	3.89±0.29^{ab}
16:0	211.48±11.77^{bc}	171.05±17.88^{c}	455.98±7.12^{a}	258.03±6.62^{bc}	436.12±3.66^{a}	279.04±29.65^{b}
16:1 Δ7c	0.97±0.07^{ab}	<0.01	1.43±0.07^{a}	1.02±0.21^{ab}	0.48±0.00^{bc}	0.75±0.11^{b}
16:1 Δ9c	9.69±0.22^{b}	6.51±0.21^{c}	20.73±0.57^{a}	9.48±0.47^{b}	1.85±0.13^{d}	0.80±0.28^{d}
16:1 Δ9t	0.13±0.00^{b}	0.14±0.01^{b}	0.34±0.02^{b}	0.34±0.11^{b}	10.86±0.49^{a}	11.50±1.51^{a}
16:1 Δ11c	25.48±0.58^{b}	21.96±1.32^{b}	52.27±3.63^{a}	32.92±0.54^{b}	48.08±1.42^{a}	32.13±3.13^{b}
17:0	2.21±0.21^{ab}	1.46±0.15^{b}	3.84±0.62^{a}	2.98±0.29^{ab}	3.30±0.01^{a}	3.14±0.11^{ab}
18:0	90.88±3.48^{cd}	76.73±3.62^{d}	178.56±8.70^{a}	102.87±2.54^{cd}	147.86±2.87^{ab}	122.91±11.77^{bc}
18:1 Δ9c	111.76±1.93^{d}	115.68±1.79^{d}	244.87±4.76^{ab}	237.67±10.86^{b}	277.58±4.37^{a}	176.65±8.91^{c}
18:1 Δ11c	561.32±21.11^{d}	468.80±9.19^{e}	1092.32±17.00^{b}	890.24±12.50^{c}	1178.89±15.48^{a}	911.55±7.98^{c}
18:2 Δ9c,12c	878.81±29.78^{c}	870.54±33.81^{c}	1960.53±30.51^{a}	1298.48±17.69^{b}	1209±9.60^{b}	810.98±5.701^{c}
18:3 Δ9c,12c,15c	4.06±0.46^{b}	2.99±0.22^{b}	8.86±0.43^{a}	3.42±0.18^{b}	<0.01	<0.01
CLA 18:2 Δ9c,11t	6.83±0.19^{a}	8.22±0.73^{a}	7.09±0.36^{a}	7.98±0.40^{a}	3.98±0.44^{b}	7.43±0.06^{a}
CLA 18:2 Δ10t,12c	9.92±0.55^{c}	15.43±1.21^{b}	27.38±079^{a}	19.17±0.65^{b}	3.89±0.17^{cd}	6.16±0.35^{d}

Table S3 (continued)

Fatty acids	1NW	2WN	3S	4EN	5NE	6NE
20:0	8.43±0.23^{b}	4.84±0.08^{c}	12.41±0.27^{a}	6.18±0.28^{c}	11.32±0.34^{a}	8.53±0.13^{b}
20:1 Δ11c	7.54±0.37^{a}	4.17±0.16^{b}	<0.01	<0.01	4.79±0.57^{b}	4.26±0.64^{b}
20:2 Δ11t,14t	6.41±0.05^{ab}	4.27±0.17^{bc}	8.20±0.48^{a}	3.02±0.20^{c}	3.41±0.37^{c}	4.49±0.83^{bc}
AcEFA 18:3 Δ9c,12c,14a	<0.01	22.07±1.20^{bc}	199.93±6.58^{a}	30.31±1.11^{b}	16.03±2.32^{bc}	6.01±0.38^{c}
AcEFA 18:3 Δ9c,12a,14c	93.13±1.74^{bc}	165.81±7.40^{a}	85.66±2.09^{c}	111.97±2.33^{b}	13.71±2.03^{d}	23.98±1.21^{d}
22:0	3.80±0.12^{bc}	<0.01	6.14±0.31^{ab}	3.45±0.06^{c}	7.41±0.75^{a}	7.09±0.67^{a}
AcEFA 18:3 Δ6a,9c,12c	107.32±2.41^{c}	189.46±7.73^{a}	132.11±1.08^{b}	146.43±3.05^{b}	12.29±0.44^{d}	23.39±1.29^{d}
23:0	<0.01	<0.01	<0.01	3.27±0.34^{a}	<0.01	<0.01
24:0	13.39±0.25^{bc}	8.35±0.74^{c}	21.21±0.28^{a}	13.00±0.50^{bc}	18.12±2.80^{ab}	16.83±1.16^{ab}
24:1 Δ15t	1.40±0.11	<0.01	<0.01	<0.01	<0.01	<0.01
MUFA	708.61±24.18	610.77±12.47	1391.23±25.48	1162.19±24.21	1520.68+22.33	1136.85±114.31
PUFA	1103.82±34.83	1275.81±52.25	2420.89±41.89	1617.36±25.42	1262.36±15.36	882.45±69.82
SFA	340.34±16.63	267.40±22.87	696.19±18.69	401.98±11.32	642.18±12.01	454.02±44.62
CLA	16.75±0.74	23.65±1.94	34.46±1.15	27.15±1.06	7.87±0.61	13.59±0.41
AcEFA	200.45±4.15	377.34±16.33	417.70±9.75	288.71±6.48	42.02±4.78	53.38±2.87

In each row, different letters indicate significant differences ($p < 0.05$) according to Tukey's HSD test. The total value for each fatty acid group is obtained by summing the values at each Site. AZA – azelaic acid; AcEFA – acetylenic fatty acids; MUFA – monounsaturated fatty acids; PUFA – polyunsaturated fatty acids; SFA – saturated fatty acids; UFA – unsaturated fatty acids; CLA – conjugated linoleic acid; AcEFA – acetylenic fatty acids.

Table S4. Names and abbreviation of fatty acids determined in *C. cibarius* extracts

No.	Fatty acids (IUPAC name)	Abbreviation
1	Nonanedioic acid	AzA
2	Dodecanoic acid	12:0
3	Tetradecanoic acid	14:0
4	Pentadecanoic acid	15:0
5	Iso-Pentadecanoic acid	i15:0
6	Anteiso-Pentadecanoic acid	ai15:0
7	Hexadecanoic acid	16:0
8	(7Z)-Hexadec-7-enoic acid	16:1 Δ7c
9	(9Z)-Hexadec-9-enoic acid	16:1 Δ9c
10	(9E)-Hexadec-9-enoic acid	16:1 Δ9t
11	(11Z)-Hexadec-11-enoic acid	16:1 Δ11c
12	Heptadecanoic acid	17:0
13	Octadecanoic acid	18:0
14	(9Z)-Octadec-9-enoic acid	18:1 Δ9c
15	(11Z)-Octadec-11-enoic acid	18:1 Δ11t
16	(9Z,12Z)-Octadeca-9,12-dienoic acid	18:2 Δ9c12c
17	(CLA) (9Z,11E)-Octadeca-9,11-dienoic acid	18:2 Δ9c11t
18	(CLA) (10E,12Z)-octadeca-10,12-dienoate	18:2 Δ10t12c
19	(9Z,12Z,15Z)-Octadeca-9,12,15-trienoic acid	18:3 Δ9c12c15c
20	(9Z,12Z)-Octadeca-9,12-dien-14-ynoic acid	18:3 Δ9c,12c,14a
21	(9Z,14Z)-Octadeca-9,14-dien-12-ynoic acid	18:3 Δ9c,12a,14c
22	(9Z,12Z)-Octadeca-9,12-dien-6-ynoIc acid	18:3 Δ6a,9c,12c
23	Eicosanoic acid	20:0
24	(11Z)-Icos-11-enoic acid	20:1 Δ11c
25	(11E,14E)-Icos-11,14-dienoic acid	20:2 Δ11t14t
26	Docosanoic acid	22:0
27	Tricosanoic acid	23:0
28	Tetracosanoic acid	24:0
29	(15E)-Tetracos-15-enoic acid	24:1 Δ15t

Gas Chromatography Profile and Mass Spectra of Tentatively Identified Acetylenic Fatty Acids (AcEFA)

Chromatographic analyses were performed using a GC (Perkin Elmer, Clarus 580) coupled to a quadrupole MS (Clarus SQ 8 C) with an ESI source. The carrier gas (helium, 99.999% purity) had a programmed flow rate of 1.0 mL/min with a 1:4 split ratio (10 mL/min). The source was operated in the positive (ESI+) mode with an electron energy voltage of 70 kV. The total ion current mode was set to m/z 25–480, with the ion multiplier voltage set to 1700 V and a scan time of 0.2 s (625 scans s^{-1}). The system was controlled by TurboMass Ver6.0.0 software, and data processing was performed using the NIST MS 2.2 Library (FairCom Corp., USA) software.

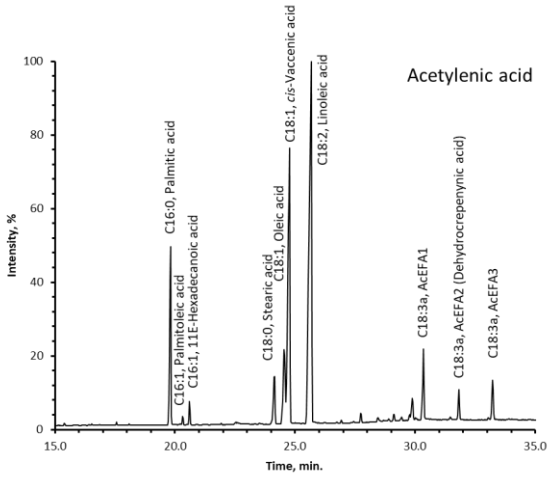


Figure S1. Gas chromatogram of conjugated acetylenic fatty acid extracted from *Cantharellus cibarius* biomass, collected in the central southern parts of the country (3S).

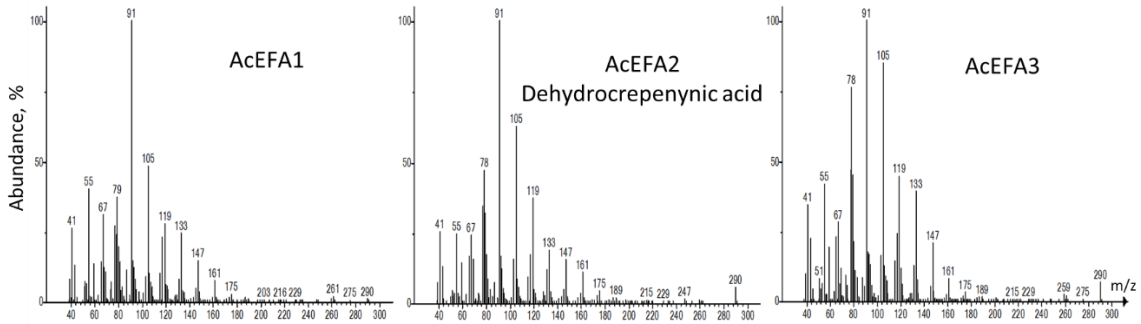


Figure S2. Gas chromatography mass fragmentation pattern of a AcAFA1 – octadeca-14-yn-9,12-dienoic acid (18:3 Δ9c,12c,14a) methyl ester; AcEFA2 – octadeca-12-yn-9,14-dienoic acid (18:3 Δ9c,12a,14c) methyl ester and AcEFA3 – octadeca-6-yn-9,12-dienoic acid (18:3 Δ6a,9c,12c) methyl ester. Concentrations of saturated and unsaturated FAMEs were quantified using external calibration with methyl heptadecanoate as the standard in the range of 5−500 µg/mL. The method's limit of detection (LOD) is 0.05 mg/mL, and the limit of quantitation (LOQ) is 0.14 mg/mL.

Water-soluble B group Vitamins and Ascorbic Acid Content

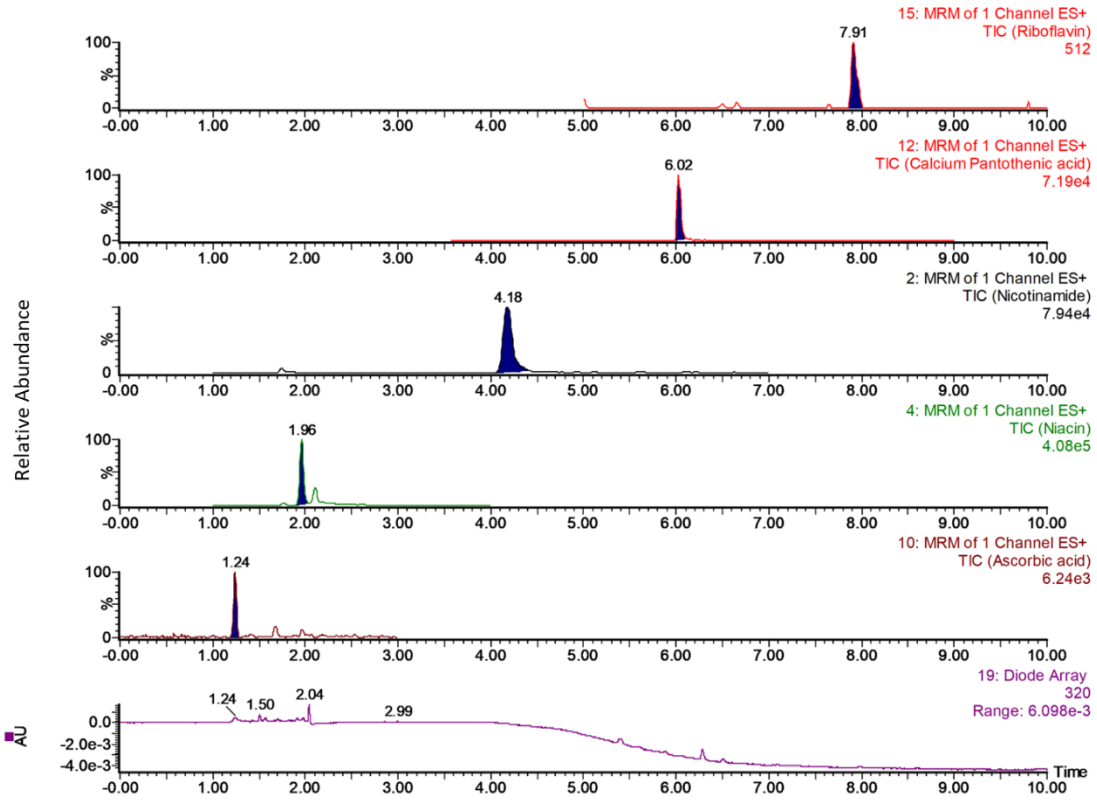


Figure S3. The UV chromatogram (320 nm) and multiple reaction monitoring (MRM) chromatograms of *Cantharellus cibarius* biomass extract obtained by LC-MS/MS (ESI+ ion mode) contain peaks indicating the content of riboflavin, pantothenic acid, nicotinamide, nicotinic acid and ascorbic acid.

Analysis of Ergosterol-derivatives in *Cantharellus Cibarius*

The analysis of TMS-derived extracts was carried out using an Elite-5MS column (30 m x 0.25 mm, 0.25 μm) as the stationary phase (Cross Bond 5% diphenyl/95% dimethyl polysiloxane). The initial temperature of the column thermostat was 250°C, increased to 265°C (0.5°C/min), then to 250 °C (4.0°C/min) and held for 25 min to 270. Analysis time 55 min. The MS ion source, detector and transfer line temperatures were 230°C, 300°C, and 300°C, respectively. The sample injector was at 300°C.

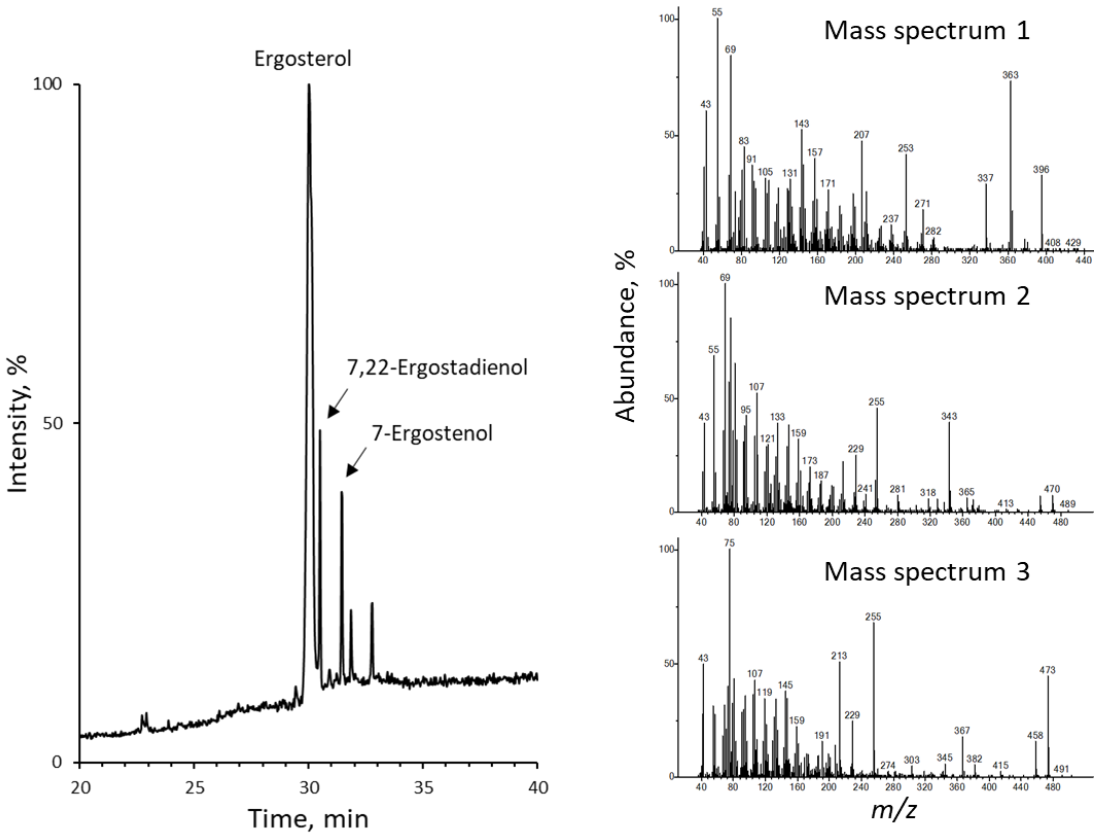


Figure S4. Gas chromatography profile of sterol compounds and mass spectrum of *Cantharellus cibarius* collected in the west-north continental region (2WN) in Latvia. Mass spectrum 1 corresponds to ergosterol (M^+, m/z 468); mass spectrum 2 correspond to ergosterol 7,22-ergostadienol (M^+, m/z 470) and mass spectrum 3 correspond to ergosta-7-enol (M^+, m/z 472). Quantitative measurements were performed using external calibration with ergosterol as standards. The method's limit of quantitation (LOQ) for ergosterol was 0.03 mg/mL, and the limit of detection (LOD) was 0.01 mg/mL.

Multiple factor analysis (MFA) of compositional date

Table S5. Partial-factor coordinates and vector lengths for each data block and sampling site

Site	Point type	Dim1	Dim2	Distance from centroid
1NW	Centroid	-3.807654	1.937161	0.000000
1NW	Elements	-5.509600	5.709262	4.138280
1NW	Fatty acids	-7.989686	-0.551818	4.866663
1NW	Sterols	-0.005252	1.502655	3.827147
1NW	Vitamins	-1.726077	1.088546	2.247912
2WN	Centroid	-6.277912	-1.175410	0.000000
2WN	Elements	-2.891735	1.866525	4.551875
2WN	Fatty acids	-14.872516	-4.599763	9.251670
2WN	Sterols	-0.639796	-1.752250	5.667548
2WN	Vitamins	-6.707602	-0.216152	1.051099
3S	Centroid	4.051117	5.982376	0.000000
3S	Elements	-0.278911	2.142456	5.787412
3S	Fatty acids	11.576331	6.897365	7.580636
3S	Sterols	2.710099	8.723094	3.051207
3S	Vitamins	2.196950	6.166590	1.863295
4EN	Centroid	1.667807	-3.910908	0.000000
4EN	Elements	6.181131	-6.447174	5.177135
4EN	Fatty acids	-1.919395	-1.681612	4.223480
4EN	Sterols	0.578257	-2.942953	1.457415
4EN	Vitamins	1.831238	-4.571895	0.680891
5NE	Centroid	5.086585	-3.432112	0.000000
5NE	Elements	6.989510	-5.807949	3.043966
5NE	Fatty acids	9.975235	-0.123374	5.903105
5NE	Sterols	-1.739549	-6.459270	7.467247

Table S5 (continued)

Site	Point type	Dim1	Dim2	Distance from centroid
5NE	Vitamins	5.121143	-1.337853	2.094544
6NE	Centroid	-0.719944	0.598893	0.000000
6NE	Elements	-4.490395	2.536880	4.239351
6NE	Fatty acids	3.230031	0.059202	3.986674
6NE	Sterols	-0.903759	0.928724	0.377594
6NE	Vitamins	-0.715653	-1.129236	1.728134

Table S6. Eigenvalues and explained variance of the MFA dimensions

Dimension	Eigenvalues	Explained variance (%)	Cumulative (%)
1	206.2338	34.088	34.088
2	136.8395	22.618	56.706
3	117.0634	19.349	76.056
4	69.1923	11.437	87.492
5	48.9986	8.099	95.591
6	12.6935	2.098	97.689
7	5.0898	0.841	98.531
8	3.6410	0.602	99.133
9	2.5757	0.426	99.558
10	1.7365	0.287	99.845
11	0.9360	0.155	100.000

Table S7. Permutational multivariate analysis of variance summary

Data block	Variables (data blocks) / dimensions (MFA)	Pseudo-F	R^2	Permu-tation p	Permu-tations
Elements	18	16.73499	0.93309	0.00020	9999
Fatty acids	29	21.14054	0.94629	0.00010	9999
Sterols	3	224.19870	0.99468	0.00020	9999
Vitamins	5	11.38101	0.90462	0.00010	9999
Integrated MFA	11	19.05746	0.94076	0.00020	9999