

# Analytical priorities for national food composition databases in Europe: results from COST Action 99 questionnaires

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## INTRODUCTION

The primary objective of COST (Co-operation in Science and Technology) Action 99 is to combine knowledge and expertise of various experts in COST countries in the area of Food Composition and Consumption in order to:

- (a) construct and establish a network of compatible food composition databases with the quality required for interpretation, description and exchange of high quality food composition and consumption data;
- (b) ensure the continuity of collection and improve the quality/harmonization of food consumption data as available from food balance sheets and household budget surveys;
- (c) continue to improve the quality and compatibility of data for inclusion in tables and databases of food composition;
- (d) maintain and improve existing food coding systems in order to exchange data efficiently.

In 1996, a questionnaire on analytical priorities was circulated as widely as possible in Europe via the national representatives of the 25 participating COST countries for the Working Party on Data Quality and User Priorities. The COST countries participating in this project are Austria, Belgium, Croatia, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg,

Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Turkey and United Kingdom.

The questionnaire had four main purposes: (i) to determine which foods and nutrients were currently being analysed in each country; (ii) to determine each country's priorities for future work, especially for nutrient database purposes; (iii) to determine which analytical methods were being used so that users of the data could have more confidence in the values, and (iv) to develop a European-wide network of analytical experts for future collaboration and co-operation between laboratories. This paper summarises the responses.

## RESULTS

There were 32 replies from 13 countries. The names and addresses of the responders are given in the Appendix at the end of this report. Most of the information received was about the nutrients and main foods being analysed, and the analytical methods being used. A summary is given in Table 1. Where there is no entry, the nutrient is not currently being analysed in that laboratory.

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Table 1. Summary of responses on analytical priorities

Nutrients	Czech Republic (Pokorný)	Finland (Karppinen)	Finland (Piiroinen)	Germany (Brueckner)	Germany (Robe)	Germany (Oehlenschlaeger)	Germany (Boehm)	Germany (Bauer-Aymanns)
Main reasons	Research and surveys	Labelling	Improved methods; missing data	Research	Labelling, improved methods and research	Food tables and research	Research	Labelling/dietetic foods
Energy	Yes				Calculation			Calculation
Fats								
Individual Fats	Capillary gc	Gc	Capillary gc		Gc			
Branched	Urea and capillary gc		Capillary gc					
Trans	Capillary gc		Capillary gc					Infrared
Long polys	Capillary gc		Capillary gc			Yes		Yes
Sterols	In fats		Free and esterified by gc		Gc	Yes		Gc
Which foods?	Fat products; other fatty foods		Important foods		Cereal products	Seafoods		
Protein								
AAs	AAA (ionex lc)	Ion exchange hplc	AA analyser, + Trip			Yes		
Nucleotides		Hplc in fish				Seafoods		Sports and dietetic foods
Which foods?	All							
Carbohydrate								
Analysed total	Yes		Yes		Enzymatic			
Individual	Oligos and resistant starch	Enzyme and spectro or hplc	Englyst		Enzymatic			Polarimetry and enzymatic
Which foods?	All		Important foods		Cereal products			
Fibre					Enzymatic/gravimetric			Yes
Total		AOAC	Englyst					
Dietary and crude fibre; cereals and legumes								
Fractions		Asp	Yes		Pectins, lignin			
Which foods?		Cereals, vegetables	Important foods		Cereal products			High fibre foods
Minerals					Na, K, Cl, Fe			
Nutrients	Na, Ca, Fe, Se, I, Mg, K, Cu, Zn, Mo, Mn, Cr, Co	Na, K, Ca, Mg, Fe, Zn, Cu, Mn, Cr, Cl, P; mostly by AAS	Se (electrothermal AAS), Zn, Cu, Mn, I			Cl, P, Zn, Cu, Se, I		Na, K (flame); P (photometry); I (ICP/MS); Ca, Mg, Fe, Zn, Cu (AAS)

Non-nutrients	Cd, Hg, As	Pb, Cd, As, Hg, Ni, Al, Sn	Pb, Cd, Hg	For Se, to monitor soil fertilisation	Cereal products	Seafoods
Fractions Which foods?	Se in infant foods	Organic Se All	Most foods		Cereal products	
Vitamins						
Retinoids	Hplc + uv/visible	Total	Yes			Hplc
Carotenoids	Spectrophotometry	Total	Hplc			RP-hplc + diode array
D			Yes			
D fractions		D3	D <sub>2</sub> , D <sub>3</sub> , 25-OH-D <sub>3</sub>	Hplc/fluorimetry		
E		Yes	Hplc			Hplc
E fractions	Hplc + ec or fluo	Yes				
K						
K fractions			Hplc			
Thiamin	Yes	Hplc	Hplc		Planned	Thiochrome Lumiflavin Microbiological
Riboflavin	Yes	Hplc	Hplc		Planned	Microbiological
Niacin/Trp	Yes	Microbiological				
Cereal niacin?	No					
B6	Yes	Microbiological	Hplc			
B6 fractions	No					
B12	No	Protein binding				
Folate	Planned	Protein binding				
Folate fractions			Hplc			
Biotin		Microbiological				
Pantothenate		Microbiological				
Vitamin C	Hplc + ec or F				Mainly fruit and veg	ELISA and microbiology
Which foods?		All	Mainly fortified foods	Important foods		
Miscellaneous						
Organic acids	Citric					
Polyols	Glycerol, sorbitol				Gc, hplc Enzymatic/gravimetric	Hplc and enzymatic
Non-nutrients						
Which foods?						



Fractions	Veg, fruit and dishes	Many foods	Selected fruit and vegetables	Most foods	Most foods
Retinoids	Hplc				
Carotenoids	Hplc		Glc	Hplc	Yes Hplc
D	Hplc			Hplc	Yes
D <sub>2</sub> and D <sub>3</sub> , and Hplc	Hplc			Hplc	
E	Hplc	Yes		Hplc	Yes
E fractions	Hplc, fluorimetric detection				
K	Planned				
K fractions					
Thiamin	Hplc			Hplc	Yes
Riboflavin	Hplc			Hplc	Yes
Niacin/Trp				Microbiological	Microbiological
Cereal niacin?				Microbiological	Microbiological
B <sub>6</sub>	Hplc			Microbiological	Microbiological
B <sub>6</sub> fractions				Microbiological	Microbiological
B <sub>12</sub>					
Folate					
Folate fractions					
Biotin					
Pantothenate					
Vitamin C	Hplc				Hplc
	Veg, fruit and dishes	Oils	Yes Yes Selected fruit and vegetables	Dairy products, cod liver oil	Microbiological Yes Infant formulas; labelled foods
Organic acids	Planned	Organic acids in wines			
Polyols					Hplc
Non-nutrients	NO <sub>2</sub> , NO <sub>3</sub> , purines, phenolics	Additives, pesticides, mycotoxins		Hplc	NO <sub>2</sub> , NO <sub>3</sub> ,
	Steradienes, terpenes, flavours	Trypsin inhibitor and phytic acid			
Which foods?	Oils, for quality control	Veg, fruit and dishes	Soya foods		Meat products and veg

Table 1.—*contd.*

	Netherlands (Hulshof)	Netherlands (Verhagen)	Norway (Gjerdevik)	Norway (Naeringsmiddel-tilsynet)	Norway (Rokke)	Portugal (Amaral)	Portugal (Andrade)	Portugal (Batista)
Reasons	Research; missing values	Contract research (labelling, toxicology, etc.)	Food tables	Food tables	Labelling, improved methods, research	Many reasons	Surveys, improved methods, labelling	Research, missing values, labelling
Energy Individual fats	Yes	Analysis and calculation			Yes	Calculated	Yes	
Branched		Glc		Glc	Glc	Capillary Glc	Yes	Glc
Trans	Glc/MS	Glc				Capillary Glc	Yes	Glc
Long polys	Glc/MS	Glc				Capillary Glc	Yes	Glc
Sterols		Glc			Enzymatic	Capillary Glc	Yes	Glc
Which foods?	Fats; snack foods	All foods		Bread, fruit, vegetables		Hplc	Oils, dairy	Fish
AAs		All foods				Fats, oils, dairy foods, dietetic foods	Oils, dairy products	
Nucleotides		Amino acid analyser Hplc + electron capture All foods				AA analyser	Yes	Ion exchange hplc
Analysed CHO Individual		Yes Yes All foods				Dietetic foods	Dairy products, meat	Hplc Fish
Fibre Fractions		Yes Yes All foods				Enzymatic	Polarimetry	Anthrone
Minerals		Yes. AAS; ICP/MS	I (ICP/MS)			Enzymatic	Yes	Titrimetric
		Yes. AAS; ICP/MS				All foods	Mainly cereals	Bivalves, surimi
		Yes				AOAC	Fibertec	
		Yes				Total, soluble and insoluble; crude fibre	van Soest	
		All foods				Dietetic foods, etc.	Raw materials	
		Yes. AAS; ICP/MS	I (ICP/MS)			Na, K, Cl, P, Ca, Mg, P, Na, K, Fe, Fe, Zn, Cu, Mn, Se. Mostly by AAS	Cu, Mn, Zn, Mg	Fe, Cu, Zn
		Yes. AAS; ICP/MS				Ca, Fe, K, Mg, P, Cr, Cu, Mn, Zn (ICP or AA); Na (neutron activation); Se, I (gamma-activity)		
		Yes. AAS; ICP/MS				Ni, Co, Al, Sb, Cr, Hg, Ba, Ag, As, Sn, Cd, Pb. Mostly by AAS	As, Sn	Cd, Hg, Pb

Fractions	Yes	All foods	Mainly processed foods	Fish
Retinoids				
Carotenoids	Yes	Hplc	Hplc	
D		Hplc	Spectrophotometry	Hplc
D fractions		Yes		
E		Hplc		
E fractions		Hplc		
K		Hplc		
K fractions		Hplc	Hplc	
Thiamin		Hplc	Hplc	
Riboflavin				
Niacin/Trp		Spectrofluorometry		
Cereal niacin?		Spectrofluorometry		
B6		Hplc	Microbiological	
B6 fractions		Hplc	Microbiological	
B12		Affinity binding		
Folate		Microbiological		
Folate fractions		Hplc	Immunoenzymatic	
Biotin		Microbiological	Microbiological	
Pantothenate		Microbiological	Microbiological	
Vitamin C		Hplc	Microbiological	
		Hplc and spectroscopy		
		All foods	Foods and feeds	Fish
Organic acids		Enzymatic		
Polyols		Enzymatic		
Non-nutrients	Yes	Additives and contaminants. Hplc, glc	Natural plant toxicants	

Table 1.—*contd.*

Reasons	Portugal (Simplicio)	Sweden (Jagerstad)	Sweden (Becker)	Slovakia (Holcikova)	Turkey (Agkurt)	Turkey (Otlis)	United Kingdom (Lumley)	United Kingdom (Southon/Finglas)
	Authentication	Research	Labelling, missing values	Many reasons	Research	Research	Many reasons	Research
Energy							Yes	Yes
Individual fats								
Branched			Capillary gc	Capillary gc	Yes	IUPAC	Glc	Glc
Trans			Capillary gc			Glc	Glc	Glc
Long polys			Capillary gc			Yes	Glc	Glc
Sterols			Fats, bread, ices, fish, infant foods	Cholesterol Many foods	Yes Various	Oils and fats	Glc	Glc Oils and fats
AAs				AAAT	AA analyser		All	
Nucleotides	Hplc	Yes						
Analysed CHO	Fruit juices	Processed foods		Many foods	Various		Yes	
Individual	Enzymatic	Resistant starch	Sugars, gc	Yes	Uv Enzymatic		Hplc or enzymatic	
Fibre	Fruit juices		Bread, ice cream	Many foods	Various		All	
Fractions	Soluble, insoluble		Yes Planned	Gravimetric	Englyst		Yes	
Minerals	Na, K, P, Ca, Mg	Se	Bread, cereals vegetables	Many foods	Cereals and other foods		Yes	
			Ca, Na, K, P, Fe, Zn, Cu, Se, Cr	Na, K, P, Ca, Mg, Fe	Na, K, P, Mg, Fe, Zn, Cu (AAS)	Yes (AAS/FES)	All; AAS, ICP/MS	Fe (total, haem), Zn, Cu, Se, Cr; AAS, ICP/MS
Fractions	Fruit juices	Se fractions Fish, meat, milk	Ni, Cd, Pb	Many foods	Various		Pb, Hg, Cd, As, Sn Yes	
			Fish, meat, dairy products, cereals	Many foods	Cereals, vegetables		All	





**ABBREVIATIONS AND REFERENCES USED IN  
TABLE 1**

AAs	amino acids
AAS	atomic absorption spectrophotometry
AOAC	Association of Official Analytical Chemists
CHO	carbohydrate
ec	electrochemical detection
ELISA	enzyme-linked immunosorbent assay
F	fluorescence
FES	flame emission spectrophotometry
gc	gas chromatography
GC-MS	combined gas chromatographic mass spectrometry
GF-AAS	graphite furnace atomic absorption spectrophotometry
IUPAC	International Union of Pure and Applied Chemists
Hplc	high performance liquid chromatography
ICP/MS	inductively coupled plasma mass spectrometry

ir	infrared
Oligos	oligosaccharides
RBA	radio-protein binding assay
Spectro	spectrophotometric
tlc	thin-layer chromatography
trp	tryptophan
UV	ultra-violet detection

**REFERENCES**

- AOAC Official Methods of Analysis (1990) *Total dietary fibre in foods, enzymatic-gravimetric method*, 15th edn, **985.29**, 1105.
- Lee, S. C., Prosky, L. and de Vries, J. W., *Journal of AOAC International*, 1992, **75**, 395.
- Englyst, H. N., Quigley, M. E. and Hudson, G. J., *Analyst*, 1994, **119**, 1997.
- Englyst, H. N., Quigley, M. E., Hudson, G. J. and Cummings, J. H., *Analyst*, 1992, **117**, 1707.
- Hart, D. J. and Scott, K. J. (1995) Development and evaluation of an HPLC method for the analysis of carotenoids in foods, and the measurement of the carotenoid content of vegetables and fruits commonly consumed in the UK. *Food Chemistry* **54**, 101–111.

Appendix: Table A1. Names and addresses of national laboratories involved in food composition work

Country/name	Address	Tel no./fax no./e-mail
<b>Czech Republic:</b>		
Prof Jan Pokorny	Department of Food Science, Prague Institute of Chemical Technology, Technicka St 5, CZ 16628, Prague 6	+ 42.2.243.53264 + 42.2.311.9990
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Prof Vieno Piironen	Department of Applied Chemistry and Microbiology, Food Chemistry Division, PO Box 27, FIN-00014, University of Helsinki, Helsinki	+ 358.9.708.5222 + 358.9.708.5175
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<b>Germany:</b>		
Dr Antal Bognar	Bundesforschungsanstalt für Ernährung, Institut für Chemie und Biologie, Garbenstrabe 13, D-70599 Stuttgart	+ 49.711.455.063 + 49.711.456.9355
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Bauer-Aymanns	Chemische Landesuntersuchungsanstalt, Hoffstr. 3, 76133 Karlsruhe	+ 49.721.926.3621
Jurgen Bruckner	Deutsches Institut für Ernuahrungsorschung, A-Scheunert-Allee 114/116, D-14558, Bergholz - Rehbrucke	+ 49.33200.188420 + 49.721.926.3549 + 49.33200.188419
Dr L Bruhl	Bundesanstalt für Getreide-Kartoffel-und Fettforschung, Institut für Chemic und Physik der Fette, Piusallee 76, D-48147 Munster	+ 49.251.4310
Dr Eckhard Robe	Federal Centre for Cereal, Potato and Lipid Research, Institute for Biochemistry of Cereals and Potatoes, Schutzenberg 12 D-32756 Detmold	+ 49.5231.7410 + 49.5231.74110 bagkf@t-online.de
Dr Volker Bohm	Institute of Nutrition and Environment of the Univ. of Jena, Dept. of Human Nutrition, Dornburger Str. 25-29, D-07743 Jena	+ 49.3641.637091 + 49.3641.637089 b5bovo@rz.uni-jena.de
<b>Greece:</b>		
Dr Char. Chamadalis	Division of Food, General Chemical State Laboratory, Ave Tsoha 16, 11521 Athens	+ 30.1.642.8211 + 30.1.646.5123
<b>Hungary:</b>		
Agnes Sallai-Parrag	University of Horticulture and Food Technology, Dept. of Canning Technology, H-1118 Budapest, Menesi ut 45, PO Box H-1502, Budapest	+ 36.1.166.7435 + 36.1.166.7435
Prof G Biro and Dr E Dworschak	National Institute of Food-Hygiene and Nutrition, H-1097 Budapest Gyali ut 3/a	+ 36.1.215.4130 + 36.1.215.1545
<b>Iceland:</b>		
Dr Olafur Reykdal	Agricultural Research Institute, Keldnaholt, IS-112 Reykjavik	+ 354.577.1010 + 354.577.1020 olafurr@rala.is
<b>Netherlands:</b>		
Ir Henri HS Roomans	Food Inspectorate for Health Protection, Florijnruwe 111, 6218 CA Maastricht	+ 31.43.354.6300 + 31.43.343.7385 igb.maastricht@pi.net
Dr Hans Verhagen	Analytical Sciences Division, Food and Non-Food Analysis Dept, TNO Nutrition and Food Research Institute, Utrechtseweg 48 PO Box 360, 3700 AJ Zeist	+ 31.30.694.4568 + 31.30.695.6742 verhagen@voeding.tno.nl
Paul Hulshof	Department of Human Nutrition, PO Box 8129, Wageningen Agricultural University, 6700 EV Wageningen	+ 31.317.484824 + 31.317.483342
<b>Norway:</b>		
Lars Rokke	Norwegian Dairies, PG 25, N-4063 Voll	+ 47.51.420511 + 47.51.420641

**Appendix: Table A1.—contd).**

Kathrin Gjerdevik	Institute of Nutrition, Directorate of Fisheries, PO Box 185, N-5002 Bergen	+ 47.55.23.8000 + 47. 55.23.8095
Local Food Control Authorities of Bergen	Mollendalsveien 2 - 4, 5009 Bergen	+ 47.55.56.7770 + 47.55.56.7518
<b>Portugal:</b>		
Ing Irineu Batista	Instituto Portugues de Investigacao Maritima, Av. de Brasilia, P - 1400 Lisboa	+ 351.1.301.7361 + 351.1.301.5948
Ana Luisa Simplicio	Instituto de Biologia Experimental E Tecnologia, Laboratorio Analitico, Apartado 12, 2780 Oeiras	—
Isilda Andrade	INETI-DTIA, Estrada do Paco do Lumiar, 1699 Lisboa Codex	+ 351.1.716.51421 + 351.1.716.3786 ipimaruq@mail.esoterica.pt
Dr Eugenia Amaral	Nutrition and Food Hygiene Department, Av, Padre Cruz, 1699 Lisbon Codex	+ 351.1.751.9200 + 351.1.759.0441
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Dr Wulf Becker	Nutrition Food Administration, Box 622, S - 751 26 S-751 26 Uppsala	+ 46.18.175.500 + 46.18.10.5848
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<b>Turkey:</b>		
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Prof Semih Otles	Ege University, Engineering Department, Bornova TR-25100, Izmir	+ 90.232.374.1401 + 90.232.388.2395
<b>United Kingdom:</b>		
Ian Lumley	Laboratory of the Government Chemist (LGC), Queens Road, Teddington, Middlesex TW11 OLY	+ 44.181.943.7342 + 44.181.943.2767
Dr Sue Southon and Paul Finglas	Institute of Food Research, Nutrition, Diet and Health Department, Norwich Research Park, Colney, Norwich, NR4 7UA, Norfolk	+ 44.1603.255176 + 44.1603.507723 sue.southon@bbsrc.ac.uk