



Publication Analysis 1997-2008

Nutrition Research

England dominates Europe's nutrition research, the Netherlands are the greatest surprise. Top topics in terms of citations were epidemiology of nutrition and disease as well as the metabolic regulation of food intake.

One of the most distinguished features of nutrition research is its wide interdisciplinarity. At the same time, however, it's one of its major problems.

That this interdisciplinarity is currently even expanding is aptly documented by some quotes from current reviews of the field. A couple of European nutrition researchers, for example, recently wrote, "Human nutrition and metabolism may serve as the paradigm for the complex interplay of the genome with its environment." And only a few lines later they added, "Mammalian metabolism has adapted to cope with rapid changes in the supply of energy, macro- and micronutrients and non-nutritional components of foods. To understand the key mechanisms underlying the metabolic regulation, the flow of information and metabolites has to be considered at all levels of the organism, starting from the molecular and cellular level onto the level of the organs' interaction. [...] Genome-wide proteome interactions are being measured and modeled at the cellular level and first attempts to include and connect all 'omic' layers have been reported as well. Nutritional science has started to adopt transcriptomics, proteomics, metabolomics and combinations thereof to assess nutritional processes in animal or human studies."

This statement, however, only describes the status quo of so-called *molecular* nutrition research. But, of course, there are still a lot more "sub-fields" as, for example, "classical" nutritional physiology and medicine or nutritional toxicology. Or take the wide field of epidemiological studies trying to assess how the risk for developing certain diseases correlates with the intake of certain foods and nutrients. And, last but not least, there is the large group of endocrinologists, diabetologists and others who study regulatory networks as well as metabolic consequences of food intake in health and disease.

Difficult balance between specialisation and breadth

"The question of specialisation and breadth is the core problem of our discipline," Hannelore Daniel, a prominent German nutrition researcher from the Technical University of Munich, recently wrote. And it's easy to guess that this fact, of course, also constitutes a "core problem" in our publication analysis of European nutrition research during the period 1997-2008. It just

leaves a slightly bad taste in one's mouth to compare in terms of citations an epidemiological study with, let's say, a molecular study of alterations in genetic networks caused by certain nutritional behaviours.

In addition, those conceptual problems were joined by the methodological ones that are inherent to this kind of publication analysis. Certainly, many "top papers" on nutrition research from the period 1997-2008 appeared in multidisciplinary science journals like *Nature*, *Science* or *The New England Journal of Medicine*. Nevertheless, at least for the comparison of the individual European countries (see "blue" table, p. 45), we had to restrict the publication analysis to the 59 expert journals listed in the subject category "Nutrition & Dietetics" of Thomson Reuter's database *Web of Science*, which was used for this analysis. The reason is a technical one: *Web of Science* doesn't provide any sufficiently reliable tools to automatically extract relevant nutrition research articles from the multidisciplinary journals. Of course, as a result, some of the most prominent papers in the field have been omitted from the "country part" of the analysis. Despite this limitation, however, we believe that a survey, restricted to the specialist journals only, still provides sufficiently valid indicators for the countries' overall productivity in nutrition research.

On the contrary, rankings of the most-cited researchers and papers (see tables, p. 46) could be analysed from publications in all journals.

High-flying Dutchmen

Applying this directive, England emerged as Europe's clear number one in nutrition research, in terms of number of publications as well as overall citations. Almost 6,800 papers were published in the "nutrition & dietetics" journals between 1997 and 2008, with at least one author from an English lab; up until April 2010 they were cited almost 100,000 times in total.

Germany, the "usual" European number two in life science research, surprisingly slipped to fourth place in nutrition research, left behind by their colleagues in France and the Netherlands. Actually, the Netherlands performed particularly strong, achieving 28% less publications than Germany, yet topping their total citation count by almost 9%. The reason, of course, is a much high-

er average citation rate: each Dutch article was cited 17.6 times on average, whereas Germany only achieved a citation-per-article ratio of 11.7.

Nevertheless, the Netherlands' mean citation rate was only third best in Europe. Two Scandinavian countries climbed even higher on the podium: Finland (18.9) and, surprisingly, Norway (17.8).

When compared to the rest of the world, Europe's nutrition research emerged with a comfortable lead over the USA in terms of total publications in the specialist journals (34,500 vs. 26,000). This lead, however, almost completely melted down when it came to total citations. Having one quarter less publications on their list than their European colleagues, the US-based researchers nevertheless collected almost the same number of total citations (432,000 vs. 421,000).

Further calculating on a global level, Canada would come in fourth by total citations, just behind France; and Japan would finish behind Germany and Italy in seventh place.

Not so surprising, the lists of the most-cited papers and authors during the years 1997 to 2008 again reflect the wide diversity of nutrition research. Among the five most-cited "nutrition papers" with a correspondence address in Europe are two epidemiological studies, one clinical trial, as well as one molecular and one endocrinological paper.

The "Top 30" list of the most-cited authors in European nutrition research, on the other hand, reveals a slight bias of researchers coming from (clinical) epidemiology and (molecular) endocrinology, probably indicating the predominating topics of nutrition research between 1997 and 2008.

"Omics" champing at the bit

Europe's number one, epidemiologist Jakko Tuomilehto from Helsinki, for example, mainly investigated the role of nutritional lifestyle in the development of a number of common diseases such as diabetes, hypertension and cardiovascular problems. Other epidemiologists like, for example, Sheila Bingham (14th) and Alicija Wolk (19th) similarly focussed on the correlation between nutrition and cancer.

The number two, Jan Åke Gustafsson, is one of the world's leading endocrinologists mainly known for his work on hormone receptors. Why then does he appear under "nutrition research"? Let's quote Gustafsson's biography as written by *PNAS* on the occasion of his election as a member of the US-National Academy of Sciences, "Focusing on a particular orphan receptor known as peroxisome proliferator-activated receptor, or PPAR, he and his laboratory showed that its ligands were fatty acids. The finding was a surprise to many nutrition scientists, who had previously assumed that fat supplied mainly calories and had no hormonal action on the body. [...] The group's discovery, published in 1992, founded the new discipline of molecular nutrition, a field that continues to grow today."

Soon after, the field received another boost by the discoveries of the hunger- and obesity-regulating hormones leptin and ghrelin. Those gave rise to a whole bunch of highly-cited follow-up studies including, for example, the ones from the labs of Philippe Froguel (4th), Johan Auwerx (5th) and Stephen Bloom (8th).

Apparently, "molecular nutrition" indeed was the second top-field in European nutrition research between 1997 and 2008. However, as noted earlier, nutritional "omic" disciplines as well as systems biology are already champing at the bit.

RALF NEUMANN

Europe...

Country	Citations	Articles	Cit./Art.
1. England	99,599	6,786	14.7
2. France	56,256	4,095	13.7
3. Netherlands	49,377	2,805	17.6
4. Germany	45,477	3,873	11.7
5. Italy	41,210	3,366	12.2
6. Spain	39,436	3,664	10.8
7. Sweden	28,347	1,806	15.7
8. Denmark	23,767	1,405	16.9
9. Switzerland	22,899	1,426	16.1
10. Finland	22,064	1,170	18.9
11. Scotland	21,873	1,464	14.9
12. Belgium	14,500	1,080	13.4
13. Norway	13,919	780	17.8
14. Ireland	12,713	986	12.9
15. Greece	9,953	896	11.1
16. Israel	7,964	602	13.2
17. Turkey	6,661	827	8.1
18. Poland	5,970	766	7.8
19. Austria	5,877	554	10.6
20. Portugal	4,631	450	10.3

Articles appearing between 1997 and 2008 in 'Nutrition & Dietetics' journals as listed by Thomson Scientific's *Web of Science*. The numbers of citations are accurate as of April 2010. A country's figures are derived from articles where at least one author working in the respective European nation is included in the author's list. Israel is included because it is a member of many European research organisations and programmes (EMBO, FP7 of the EU...).

... and the World

		Articles	Cit./Art.
Europe	431,903	34,486	12.5
USA	421,137	25,978	16.2
Canada	53,473	3,763	14.2
Japan	39,960	3,940	10.1
Australia	34,469	2,587	13.3
China	15,394	1,443	10.7
India	13,251	1,572	8.4



Publication Analysis 1997-2008 – Nutrition Research

Most Cited Authors...

	Cit-ations	Art-icles
1. Jakko Tuomilehto , Dept. Publ. Health Univ. Helsinki	32,879	508
2. Jan-Åke Gustafsson , Med. Nutr. Karolinska Inst. Stockholm	30,077	447
3. George Davey Smith , Soc. Med. Univ. Bristol	21,643	534
4. Philippe Froguel , Genomic Med. Imperial Coll. London	16,183	252
5. Johan Auwerx , Integr. & Syst. Physiol. ETH Lausanne	15,808	190
6. Michael E.J. Lean , Human Nutr. Royal Infirm. Lanark Univ. Glasgow	14,668	122
7. Jens J. Holst , Med. Physiol. Panum Inst. Univ. Copenhagen	14,636	386
8. Stephen R. Bloom , Invest. Sci. Imperial Coll. London	13,676	252
9. Nick J. Wareham , MRC Epidemiol. Unit Univ. Cambridge	11,898	309
10. Stephen O'Rahilly , Metabolic Med. Univ. Cambridge	11,281	200
11. David J.P. Barker , MRC Epidemiol. Resource Ctr. Univ. Southampton	10,802	176
12. Mohammad A. Ghatei , Invest. Sci. Imperial Coll. London	10,391	170
13. Nicholas E. Day , Publ. Health & Primary Care Univ. Cambridge	10,241	235
14. Sheila Bingham , Diet & Canc. Grp. MRC Cambridge († 2009)	10,133	309
15. Tim J. Cole , Epidemiol. UCL Inst. Child Health, London	9,776	202
16. Matti Uusitupa , Publ. Health & Clin. Nutr. Kuopio Univ. Hosp.	9,479	226
17. Helmut Sies , Biochem. & Mol. Biol. Univ. Düsseldorf	8,986	222
18. Elio Riboli , Unit Nutr. & Canc. Int. Agcy Res. Canc. Lyon	8,722	239
19. Alicja Wolk , Nutr. Epidemiol. Karolinska Inst. Stockholm	8,607	219
20. Timothy J. Key , Epidemiol. Unit Radcliffe Infirm. Univ. Oxford	7,916	177
21. Daan Kromhout , Human Nutr. Univ., Wageningen	7,837	183
22. Gary Williamson , Nestlé Res. Ctr. Lausanne	7,781	165
23. Herman Adlercreutz , Prevent. Med. Nutr. & Canc. Univ. Helsinki	7,775	186
24. Rudolf Kaaks , Clin. Epidemiol. German Canc. Res. Ctr. Heidelberg	7,702	206
25. Peter Arner , Lipid Lab. Karolinska Inst. Huddinge/Stockholm	7,677	181
26. Göran Hallmans , Nutr. Res. Univ. Umea	7,436	220
27. Kay-Tee Khaw , Clin. Gerontol. Univ. Cambridge	7,402	255
28. Clive Osmond , MRC Epidemiol. Resource Ctr. Univ. Southampton	7,317	146
29. Heiner Boeing , Epidemiol. German Inst. Human Nutr. Potsdam	7,136	269
30. Erika Isolauri , Pediatr. Turku Univ. Hosp.	6,885	152



Citations of articles published between 1997 and 2008 were recorded up until April 2010 using the *Web of Science* database from Thomson Reuters. The "most cited papers" had correspondence addresses in Europe or Israel.

... and Papers

	Citations
1. Tuomilehto, J; Lindstrom, J; Eriksson, ...; Uusitupa, M; ...; Mannelin, M; Martikkala, V; Sundvall, J Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. <i>NEW ENGLAND JOURNAL OF MEDICINE</i> , 344 (18): 1343-1350 MAY 3 2001	2,571
2. Cole, TJ; Bellizzi, MC; Flegal, KM; Dietz, WH Establishing a standard definition for child overweight and obesity worldwide: international survey. <i>BRITISH MEDICAL JOURNAL</i> , 320 (7244): 1240-1243 MAY 6 2000	2,324
3. Valagussa, F; Franzosi, MG; Geraci, E; ...; Franzini, C; Gonano, F; Graziani, MS Dietary supplementation with n-3 polyunsaturated fatty acids and vitamin E after myocardial infarction: results of the GISSI-Prevenzione trial. <i>LANCET</i> , 354 (9177): 447-455 AUG 7 1999	1,612
4. Clement, K; Vaisse, C; Lahlou, N; ...; Lebouc, Y; Froguel, P; Guy-Grand, B A mutation in the human leptin receptor gene causes obesity and pituitary dysfunction. <i>NATURE</i> , 392 (6674): 398-401 MAR 26 1998	979
5. Wren, AM; Seal, LJ; Cohen, MA; Brynes, AE; Frost, GS; Murphy, KG; Dhillon, WS; Ghatei, MA; Bloom, SR Ghrelin enhances appetite and increases food intake in humans. <i>JOURNAL OF CLINICAL ENDOCRINOLOGY & METABOLISM</i> , 86 (12): 5992-5995 DEC 2001	887