Nutrition and Health

Through RIVM’s research into the relationship between nutrition, lifestyle and health, a scientific basis is created for policy-making and surveillance with the ultimate aim of achieving health gains for the Dutch population. The expertise in nutrition and health is delivered by RIVM’s nutritionists, epidemiologists, medical doctors, modellers and toxicologists. RIVM’s activities are funded mainly by the Dutch government, the EU, and specialized governmental and non-profit organizations for scientific research.

Nutrition and health are topical subjects for which interest in the near future will only continue to increase.

Information: Dr. H. Verhagen (hans.verhagen@rivm.nl)

* Cardiovascular diseases
** Post-launch monitoring
Knowledge-integrated reports

‘Our food, our health: healthy diet and safe food in the Netherlands’ was composed at the RIVM at the request of the Ministry of Health, Welfare and Sport to provide an overview of available knowledge on healthy nutrition and safe foods in the Netherlands. Knowledge from laboratories and centres at RIVM are integrated in this thematic-based report, with supplemental contributions coming from experts representing other institutes and universities. RIVM’s Centre for Nutrition and Health is the coordinating centre for thematic reports on nutrition and health.

International activities

The RIVM participates in various networks such as the European Network for Public Health Nutrition and the Network on Nutrition and Physical Activity and in various EU research collaboration projects, e.g. EPIC, DIOGENES, QALIBRA, NUGO, BRAFO, EUROFIR and EFCOVAL. The RIVM also provides services and expertise to international agencies and sister institutions inside and outside Europe; examples are DG SANCO, ILSI, WHO and CDC-China. Furthermore, the RIVM compiles scientific background documents for use as input in scientific fora or policy-making processes.

Commissioning bodies

The Dutch Ministry of Health, Welfare and Sport www.minvws.nl/en
Food and Consumer Product Safety Authority (VWA) www.vwa.nl
European Union; DG Sanco / DG Research www.europa.eu.int
European Food Safety Authority http://www.elsa.eu.int
World Health Organisation http://www.who.int

Cooperating institutions/organizations

TNO www.tno.nl
Wageningen University and Research centre www.wur.nl
Utrecht University www.um.nl
Maastricht University www.unimaas.nl
Radboud University Nijmegen http://www.ru.nl/english
ILSI Europe: The International Life Sciences Institute http://europe.ilsi.org/
CDC China: The Chinese Center for Disease Control and Prevention http://www.chinacdc.cn

Information: Dr. J.M.A. van Raaij (joop.van.Raaij@rivm.nl)
Dutch national food consumption surveys

Insight into the food consumption and nutritional status of the Dutch population is essential for an adequate policy on nutrition and food safety. Under the authority of the Ministry of Health, Welfare and Sport, dietary intake data for the whole population have been collected periodically since 1987 in food consumption surveys (1987, 1992 and 1998).

Changes in policy needs and food habits, along with socio-demographic developments, have made it necessary to adjust the methodologies for dietary assessment. RIVM and TNO have cooperated in conducting food consumption survey according to the new methodology since 2003, in which information is now obtained from individuals, not just members of a household.

The food consumption survey data give insight into the consumption and intake of foods and macro- and micronutrients, and into potentially harmful chemicals with their associated trends. From 2007 data collected will cover the general population aged 7 to 69 through 24 hour recalls. Supplementary data collection is necessary for young children, migrants, pregnant and breastfeeding women and the elderly. We started with the collection of this extra data for young adolescents in 2003 and children in 2005. Supplementary data collection is also needed to obtain information on important products, consumed only by a small minority of the population. Targeted research may be useful where food consumption surveys indicate specific nutritional problems. (see figure)

Figure: Modules of the Dutch dietary monitoring system.

Please see http://www.rivm.nl/vcp for general information on the Dutch national food consumption surveys, and papers and reports on this topic.

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Dutch national food consumption surveys
RIVM reports, 2003-2005


RIVM Publications 2000-2005


**Nutrigenomics**

Nutrigenomics studies the interactions between nutrition and genes. Genetic variation can have an effect on the metabolism of nutrients, such as carbohydrates, fatty acids and fibres. People with a certain genetic background may run an increased or decreased risk of contracting certain chronic diseases, depending also on their dietary habits.

Cardiovascular disease, type 2 diabetes and obesity, also collectively known as ‘the metabolic syndrome’ are important chronic conditions generated through a common etiological pathway. Nutrition, which plays an important role in the occurrence of these disorders, can be seen as a significant preventive factor. New insights into the human genome have shown that these multi-factorial diseases are also affected by genetic susceptibility to the impact of drugs (pharmagenomics) and nutrients (nutrigenomics).

The RIVM focuses its research on the genetic susceptibility for the metabolic syndrome. An important aspect here is the interaction between genetic polymorphisms and dietary factors, and the risk of developing the metabolic syndrome. Research focuses on overweight, high blood pressure, elevated plasma lipid and glucose levels, along with their sequelae, e.g. cardiovascular disease and diabetes.

**Biobank**

RIVM’s biobank houses blood samples of about 55,000 individuals, randomly sampled from the Dutch population. The biobank is connected up to an extensive database with information on diet, lifestyle, risk factors and chronic diseases, obtained through questionnaires and links with registries on mortality and morbidity.

**International coorporation**

In Europe, RIVM collaborates with NUGO, the European Nutrigenomics Organization; DIÖGENES and Interact, two EU-funded integrated projects on diet, genes and obesity or diabetes, respectively; and EPIC, the European Prospective Investigation on Cancer. EPIC also includes Epic-Heart and Epic-Diabetes.

Information:
Dr. J.M.A. Boer (JMA.Boer@rivm.nl)
Dr. D.L. van der A (Daphne.van.der.A@rivm.nl)
The plasminogen activator inhibitor-1 (PAI-1) promoter haplotype is related to PAI-1 plasma concentrations in lean individuals. Verschuur M; Jellema A; Bladbjerg EM; Feskens EJM; Mensink RP; Moller L; Vos HL; Maat MPM de. Atherosclerosis 2005; 182(2):275-84.

Dietary intake of folate and riboflavin, MTHFR C677T genotype, and colorectal adenoma risk: a Dutch case-control study. Donk M van den; Buijsse B; Berg SW van den; Ocke MC; Harryvan JL; Nagengast FM; Kok FJ; Kampman E. Cancer Epidemiol Biomark Prev 2005; 14(6):590-8.

Common variants in the ATP-sensitive K+ channel genes KCNJ11 (Kir6.2) and ABCC8 (SUR1) in relation to glucose intolerance: population-based studies and meta-analyses-Dam RM van; Seidell JC; Schaap MM; Bruin TWA de; Feskens EJM. Diabetic Med 2004; 22(5):590-8.

The insulin receptor substrate-1 Gly972Arg polymorphism is not associated with Type 2 diabetes mellitus in two population-based studies-Dam RM van; Seidell JC; Schaap MM; Blaak EE; Feskens EJM. Diab Med 2004; 21:752-8.


Leptin responsiveness to energy restriction: genetic variation in the leptin receptor gene- Mars M; Rossum CTM van; Graaf C de; Hoeebe B; Groot CPDM de; Kok FJ. Obesity Res 2004; 12:442-4.

Leptin and insulin responses to a four-da energy-deficient diet in men with different weight history- Mars M; Graaf C de; Rossum CTM van; Groot CPDM de; Seidell JC; Kok FJ. Int J Obesity 2003; 27:574-81

A common variant of the methylenetetrahydrofolate reductase gene (1p36) is associated with an increased risk of cancer- Heijmans BT; Boer JMA; Suchiman HED; Cornelisse CJ; Westendorp RGJ; Kromhout D; Feskens EJM; Slagboom FE. Cancer Res 2003; 63:1249-53.


Genetic variation in the leptin receptor gene, leptin, and weight gain in young Dutch adults-Rossum CTM van; Hoeebe B; Baak MA van; Mars M; Saris WHM; Seidell JC. Obes Res 2003; 11:377-86.


Integrated benefit–risk assessment

Nutrition exerts positive health effects but in some cases negative health effects cannot be excluded. Some examples of foods with both positive and negative effects on health are presented in the table below. To determine the overall health impact of specific foods, the positive and negative health effects should be quantified and combined to an integrated health measure: e.g. DALY (Disability Adjusted Life Year). In this way, positive and negative effects on morbidity and mortality in the population can be weighed against each other.

One of the pillars for a risk-benefit calculation are recent intake data that assist in getting insight in the current risk-benefit balance for foods consumed by the Dutch population. The risk-benefit method can be used to support food policy, in particular for foods and ingredients which have both positive and negative effects on health, e.g. functional foods.

<table>
<thead>
<tr>
<th>Traditional foods</th>
<th>‘Benefits’</th>
<th>‘Risks’</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish</td>
<td>Coronary heart disease ▼</td>
<td>Neurological damage to the fetus / microbial contamination</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Functional foods</th>
<th>‘Benefits’</th>
<th>‘Risks’</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cholesterol-lowering margarines</td>
<td>Cholesterol level ▼</td>
<td>β-carotene level ▼</td>
</tr>
<tr>
<td>Folic acid enriched foods</td>
<td>Neural tube defects ▼ Homocysteine ▼</td>
<td>Masking of vitamin B12 deficiency</td>
</tr>
<tr>
<td>Probiotics</td>
<td>Diarrhoea in children ▼</td>
<td>Immune modulation?</td>
</tr>
</tbody>
</table>

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Information: Dr. N. de Jong (Nynke.de.Jong@rivm.nl) Dr. C.J.M. Rompelberg (Cathy.Rompelberg@rivm.nl)
Health effects of nutrition in models

RIVM develops models to quantify the effects of nutrition on health and on the measures to be taken. Results are used to support the Dutch government’s nutrition policies. Although the models differ from each other, they are based on the same concept. (see figure) The models are based on the relative risks or odds ratios from literature research of different diseases. Health effects are simulated according to the (modified) intake of a nutrient or food item in the population. These quantified health effects can be combined into one health measure, the DALY (Disability Adjusted Life Years). An economic evaluation can also be taken into account.

Examples of research questions answered with the models:

**Chronic Disease Model**
- What is the health loss in the Dutch population due to too much saturated and trans fatty acids, too less fruit and vegetables and/or too less fish consumption?
- What would be the health gain/health loss of different dietary interventions? For example an intervention in which every primary school serves two times a week fruit and vegetables?
- Are such interventions cost-effective?

**Breastfeeding Model**
- How large is the health gain/health loss when breastfeeding is promoted?
- With which policy can the largest health gain be achieved? For example a policy focusing on the non-breastfeeding mothers or a policy focusing on extending the lactation period?
- What would be the economic consequences of these policies?

**Risk-Benefit Model:**
- How large are the positive and negative effects when certain products are enriched with a certain bio-active component, as for example folic acid?

**RIVM reports and publications**

- *How healthy is breastfeeding? (Hoe gezond is borstvoeding?)* Voeding Nu;3:9-11, Rossum CTM van, Büchner FL, Hoekstra J. 2006.

Information: Dr. C.T.M. van Rossum (Caroline.van.Rossum@rivm.nl)
**Functional foods and food supplements**

Functional foods are foods with a nutrition or health claim. One or more specific ingredients of these products have been added or their concentrations have been changed in order to contribute to a healthy dietary pattern. Manufacturers claim that these foods have additional positive effects on health beyond traditional foods. Examples include the addition of phytosterols and phytostanols to margarine, calcium to milk, probiotics to yoghurt drinks, and 'diet' products with a reduced fat or sugar content.

Dietary supplements (also known as nutraceuticals or health products) are another category of food products which are claimed to have beneficial effects on health. These products are often presented as pharmaceutical preparations, such as tablets or mixtures, but are not medicines. Examples are vitamin and mineral supplements and herbal preparations.

**Post-launch monitoring (PLM) system**

The RIVM is developing a monitoring system in which both expected and unexpected effects of functional food and dietary supplement consumption can be monitored. This post-launch monitoring (PLM) should start after marketing of the product and under customary usage conditions. Most of the decision-making criteria for the different stages in this PLM-system and the methods and framework for the data analyses have been established. For future PLM purposes it will be important to create links between dietary surveys and other databases such as disease registry systems.

**PLM system for health effects**

- **Nutrition database**
- **Supplements database**
- **Determination food intake**
- **Status of nutrition and health**

- Passive signaling of consumer complaints (a)
- Active signaling of health effects based on investigation of data (b)

- Determine relevance data a and b

- Quantification health effects at population/group level

- Risk-benefit analysis

- Risk-benefit management

**Information:**

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Assessing the safety of novel foods

The RIVM participates in the Dutch Committee on the Safety Assessment of Novel Foods (CSA) and in the EFSA panel on nutrition, the dietetic products and allergies. A novel food contains ingredients which have not been consumed to a significant degree in Europe prior to 15 May 1997. It may be a product that is consumed outside the EU, a product that contains specific bio-active ingredients (‘functional foods’) or a product derived from new sources or obtained by new processes. The Dutch Committee forms part of the Novel Foods Unit of the Medicines Evaluation Board (MEB), which advises the Minister of Health, Welfare and Sport on the safety of novel foods and novel food ingredients.

RIVM Reports 2003-2005


RIVM Publications 2003-2006

- The combined use of cholesterol-lowering drugs and cholesterol-lowering bread spreads: health behavior data from Finland- Jong N de; Simojoki M; Laatikainen T; Tapanainen H; Valsta L; Lahtikoski M; Utela A; Vartiainen E. Prev Med 2004; 39:849-55.
- Potential intake of phytosterols/-stanols: results of a simulation study- Jong N de; Pijpers L; Bleeker JK; Ocke MC. Eur J Clin Nutr 2004; 58:907-19
- The opinion of Dutch dietitians about functional foods- Jong N de; Hoendervangers CT; Bleeker JK; Ocke MC. J Hum Nutr Diet 2004; 17:55-62.
- Demographic and lifestyle characteristics of functional food consumers and dietary supplement users- Jong N de; Ocke MC; Brandershorst HAC; Friele R. Br J Nutr 2003; 89:273-81
- Effectiveness of customary use of phytosterol/-stanol enriched margarines on blood cholesterol lowering-Wolfs M de; Jong N de; Ocké MC; Verhagen H; Verschuren WMM. Food Chem Tox 2006; 1682-1688.
Epidemiological research on diet, lifestyle and chronic diseases

Epidemiological research has a long history at the RIVM. Research on cancer started in the 1970s, with research on cardiovascular diseases (CVD) and diabetes following in the 1980s, and obesity in the 1990s. For most of the cancer research in humans RIVM collaborates with the WHO International Agency for Research on Cancer (IARC). RIVM has databases and biobanks at its disposal that contain data on more than 55,000 Dutch subjects. This information was obtained in two large population studies investigating the role of nutrition, physical activity and genes in the development of the most life-threatening chronic diseases in the Western world, including cancer, CVD and diabetes. These studies also look into overweight and ageing.

The Monitoring Project on Cardiovascular Risk factors (PPHV) was set up in the 1980s. This was followed in the 1990s by the MORGEN-EPIC study, the Dutch part of the European Prospective Investigation into Cancer and Nutrition (EPIC). EPIC is one of the largest longitudinal investigations in the world on the role of lifestyle, genetic susceptibility and the development of cancer. RIVM scientists collaborate intensively with other national and international teams in this study.

Over the last 15 years more than 120 publications on chronic diseases (co-)authored by CVG scientists have appeared in the international scientific press. And the number of publications is rising steadily.

Published findings may in part form the rationale for more tailored policy on desirable health-promoting behaviour and for assessing the proportion of chronic diseases mentioned above which, theoretically, may be preventable.

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RIVM reports, 2003-2005

• Biobank voor onderzoek naar chronische ziekten (Biobank for research on chronic diseases). Overzicht van de opbouw en het gebruik van de bloedverzamelingen van RIVM-cohorten.
Publications RIVM 2003-2005

- Quitting smoking may restore hematological characteristics within five years. Van Tiel E, Peeters PHM, Smit HA, Nagelkerke NJD, Van Loon JM, Grobbee DE, Bueno-de-Mesquita HB. Annals of Epidemiology, 2002;12B:378-388.
- NAT2 slow acetylation and GSTM1 null genotypes may increase postmenopausal breast cancer risk in long-term smoking women. van der Hel OL, ..., Kromhout D, Bueno de Mesquita HB. Pharmacogenetics. 2003 Jul;13(7):399-407.