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**Authors(s)** | Gormley, T. R. (Thomas Ronan)
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Dear Health Professional: This pamphlet is to alert you to the results from eight nutrition-related projects in a major European food research programme called FLAIR. If you require more information, please send a FAX to the contact person listed below for each project.

What is FLAIR?

FLAIR is the acronym for Food Linked Agro-Industrial Research and is the first research programme of the EU dedicated to food. The themes food quality, food safety and food wholesomeness were chosen as they are major concerns of the food industry and others in the chain, including health professionals and consumers. An additional aim of FLAIR was to improve the competitiveness of the European food industry. The FLAIR programme commenced in 1990 and concluded officially in 1993. It embraced 33 major projects, each with participants from different countries, thereby combining the best expertise - over 500 persons - in Europe. Brief results from the eight nutrition-related FLAIR projects are given in this pamphlet.

Eurofoods-Enfant project

The objective of the Eurofoods-Enfant project was to improve the quality and comparability of food consumption and food composition data in Europe. The project embraced a number of areas including food balance sheets, household budget surveys, individual dietary intakes, evaluation of national databases, food coding systems and establishing a network. Work on food balance sheets started with the preparation of an inventory. Guidelines were then developed for the collection of data to be used for the compilation of European food balance sheets. Meetings were organised to discuss and formulate recommendations for various aspects of household budget surveys, food coding of household budget surveys in EU countries was examined with regard to the Eurocode and Eurostat food coding systems and special software was developed in order to compare the data. Work on European studies on individual dietary intake concentrated on compiling data from existing surveys. It was decided, therefore, to prepare a supplement to an existing inventory of European dietary studies, which was published in 1989. Another project aim was to identify differences in national databases. This resulted in the handbook Food Composition Data: Production Management and Use, which was published in November 1992 by Elsevier Applied Science Publishers.

A well developed and documented food coding system is essential in order to improve the comparability of data and to ensure that data from different databases and studies can be exchanged. Evaluation of Eurocode showed that there were some inconsistencies and gaps in the present code. With Langua, the general impression is that it is sufficiently comprehensive to be used as a common food description model. However, computer-aided tools need to be developed to support the coding systems. The Eurofoods-Enfant project has also supported and co-operated in the development of a European Nutrition Information Management System (EuroNIMS), and has published an inventory of software for use with nutrient databases.

An ongoing activity resulting from the Eurofoods-Enfant project is a biennial European post-graduate course on 'Production and Use of Food Composition Data in Nutrition' which is held in Wageningen. The first course took place in October 1992, the second in October 1994, and a third is planned for October 1996. Activities of Eurofoods-Enfant under FLAIR have now ceased but the Project is continuing as COST Action 99.

For more information contact Dr. C.E. West, Wageningen Agricultural University, Department of Human Nutrition, The Netherlands, Fax: +31-8370-83342.

Micronutrient availability

The full title of this FLAIR project was The Measurement of Micronutrient Absorption and Status. Its primary objectives were to assess critically the priorities for the study of dietary micronutrients (vitamin and trace elements) in the European Union and to develop and validate methods that would allow more accurate and sensitive measurement of the intake, absorption and status of these micronutrients in humans. The project comprised over 40 participants from 9 EU and 3 EFTA countries and attained all its main targets. Some of the conclusions from the final report were: Although all micronutrients are important in the European context, iron, copper, selenium, vitamin C, vitamin D, phloretin, the carotenoids, zinc, the folates and other...
B-group vitamins merit particular attention because of perceived health effects or inadequate assay procedures. Although good inter-laboratory agreement was found when assaying some micronutrients, further improvements are required in many areas. The project has been particularly successful in improving and standardising a number of assay techniques. There is also a need to standardise and harmonise methods used to assess trace element intake in Europe. Very encouraging data were obtained by using stable isotope methods for studying mineral and trace element metabolism and participants in the project are actively promoting these techniques through a number of publications. The interpretation of micronutrient data, not simply methodological differences, needs further investigation and harmonisation, so that generally accepted cut-off values can be established for most micronutrients. Although indicators of clinical deficiencies of micronutrients are generally well established, there is still a need to identify key parameters that relate dietary intake to optimal health. The intake of toxic trace elements in Europe does not appear to constitute a major health problem. The network of European scientists involved in micronutrient research formed during the course of this project provides a firm base for additional future international and inter-disciplinary collaboration.

For more information contact Dr F. Mellon, AFRC Institute of Food Research, Norwich, England. Fax: +44-1603-452578.

Resistant starch (EURESTA)

In 1982 a ‘new’ starch fraction called resistant starch (RS) was ‘discovered’ thanks to improved analytical methods. RS is not absorbed in the small intestine of healthy individuals and has, therefore, its main physiological effects in the large intestine, where it provides substrate for the microflora, together with the non-starch polysaccharides of dietary fibre. Within the FLAIR project, called EURESTA, 40 European groups from universities, research institutes and industry have collaborated to explore the physiological implications of RS consumption in man. Different chemical forms of RS have been characterised and methods for their measurement developed and evaluated. The present intake of RS in Europe seems to be rather low, around 4 g/day. By choice of raw materials and processing methods, studied within the project, products with a high RS content can be produced. For instance, one of the groups produced an excellent white bread with almost 10% RS on a dry matter basis. The main physiological effects of RS occur in the large intestine. RS from various sources is fermented by the intestinal bacteria, producing short-chain fatty acids (acetate, propionate, butyrate) and gases. Evidence is accumulating that such fermentation products are beneficial for the health of the large intestine. For instance, lowering of pH and the presence of butyrate both seem to protect against cancer of the colon. The energy value of RS is lower (about 2 kcal/g) than that of absorbable carbohydrates, but not zero owing to absorption of fermentation products.

The concerted action on RS has brought together practically all European groups active in the field. Considerable progress regarding chemistry, analysis, technology and the physiological effects of RS has been made, forming a basis for further exploration of health effects of this food component.

For more information contact Professor N.-G. Asp, Chemical Centre, University of Lund, Sweden, Fax: +46-46-104532.

Functional fibres

Studying the production and utilisation of fibres with enhanced functional qualities and beneficial properties is the topic of a FLAIR project that is still ongoing; the end-point is the use of these fibres in commercial food products. The tasks have involved obtaining fibre-rich materials, their modification, and their comparative evaluation against controls. Four fibre-enriched materials have been produced from apples, peas, wheat and cauliflower following a screening study of fibre-rich fractions from 11 different vegetable by-products. For example, pea fibres can be produced by a dry treatment and have a high total dietary fibre (TDF) content of 90%. A washing treatment with cold water to eliminate the watersoluble substances (mainly sucrose) in apple gave a refined product of 80.5% TDF. An air-drying process has been used to get a percent-rich wheat flour, which has a TDF content of 72% while a dephytinisation treatment was used to achieve a reduced phytate content. Lastly, fibre fractions have been produced from cauliflower flours, upper stem and lower stem. The TDF content of these is between 50 and 60%.

Properties of the fibres include water-binding capacity, fat-absorption capacity, and their ability to swell. Treatment with sodium hydroxide increases the swelling and water-binding capacity of pea fibres while apple fibres treated with nitric acid exhibit much enhanced physicochemical and functional characteristics; extrusion has a smaller effect on apple and wheat fibres. Based on these functional properties, food products with good sensory and physical quality (meats, biscuits, sauces) and a high TDF content have been formulated. Apple fibres exhibit a high fermentability, while pea fibres are slowly fermented. All the fibres exhibit bile acid binding, which has a positive effect on cholesterol metabolism.

For more information contact Professor G. Bourgeois, ADEIA, Quimper, France, Fax: +33-98-90-73-28.
Nutritious cereal products

Interest in nutrition is driving consumer demands for lower levels of fat, sugar and calories in foods. The food industry is being challenged to redesign traditional foods for optimal nutritional value, while making them taste the same or better. The objective of the FLAIR research project: 'New technologies and raw materials for attractive and nutritious cereal products' is to develop and apply technologies leading to low fat cereal products with attractive sensory properties. The project embraces studies at molecular, technological and ingredient levels with particular emphasis on fat functionality and fat replacement. For example, molecular studies showed that the possible fat replacers sugar beet fibre and crossbound wheat starch behave differently from fat and interfere with starch gelatinisation and result in increased retrogradation. Technological studies showed that starch gelatinisation and gluten denaturation during baking are not affected by the fat content but by the moisture content.

It is possible to reach a fat replacement of up to 80% in yeast-leavened heavy-fruited doughs ('Stollen' and 'Sutten') by use of a cocktail of different ingredients. However, when fibre enrichment (circa 8%) is desired, lees fat replacement can be achieved. The quality of low-fat cream crackers can be improved by the use of enzymes and spray-dried wheat gluten in combination with a protein rich flour; the aim was to achieve more relaxation of the gluten during dough processing.

Fibres can be used as a crumb softener in conjunction with maltodextrin and standard systems in reduced-fat cakes by bringing moisture to the crumb. Low-fat biscuits can be developed by the use of enzymes, starch and emulsifier. These results are of significance to the milling and baking industry, to ingredient suppliers, to meal planners; and to the diet-conscious public.


Lectins and carbohydrates

Lectins and certain carbohydrates have the potential to block the infection of the gut by pathogenic bacteria; lectins are proteins/glycoproteins occurring in all food plants. Until now, antibiotics have been used to keep bacteria at bay in animals but this can create health problems for humans. Manufacturers and farmers are under increasing pressure from the EU and consumers to use natural foodstuffs in this 'green' age - hence, the importance of the FLAIR project on food lectins. The most important finding of this FLAIR project was that the harmful overgrowth of E. coli in the rat small intestine was significantly inhibited by the incorporation of mannose-specific lectins in the diet. The results also suggested that mannose-specific lectins might be used not only to prevent the overgrowth of E. coli but also to block the infection of the gut by other Type 1 bacteria, including pathogens. As these lectins are not toxic for higher animals, this method of prevention of infection i.e. 'chemical probiosis' is of particular value and relevance to humans; i.e. the incorporation of these lectins in the diet may provide a natural means to improve both the nutritional value and the safety of the human diet. In addition to plant lectins, low and/or high molecular weight carbohydrates of plant or animal origin, which have similar structures to gut brush-border-receptors of bacteria, were also shown to be effective in reducing the extent of colonisation of the gut by pathogenic bacteria.

Practical applications of chemical probiosis for the blockage of harmful bacterial proliferation in the small intestine of man and animals by dietary means are now well advanced. Thus, high concentrations of dietary mannose have been found to be effective in reducing salmonella infection in chicken, with possibly beneficial consequences for humans. Indeed, most food/feed manufacturers market various probiotic products containing carbohydrate-based active ingredients. However, lectins are more powerful probiotic agents, as the amounts required for blocking adhesion sites for bacteria are small compared with the high sugar concentrations needed for competitively inhibiting bacterial binding.

For more information contact: Dr A. Pusztai, Rowett Research Institute, Aberdeen, Scotland. Fax: +44-224-716687.

Probiotic bacteria

Another FLAIR project has developed a number of unique bacterial strains with probiotic properties, i.e. they have the potential to restore a bacterial flora in the small intestine that is rich in probiotic (good) bacteria and devoid of bad bacteria (pathogens). This gives industry the opportunity of producing a range of new foods with enhanced probiotic properties. Of course, probiotics are not new! - the probiotic properties of yoghurt have been recognised for centuries. In the project, probiotic strains (lactobacilli and bifidobacteria isolated from humans and dairy products) were selected and were shared by all the investigating partners as a project culture collection. Six lactobacilli and three bifidobacteria were selected for further evaluation. It has been demonstrated that some strains, when supplied in sufficient number, are able to survive passage through the gastrointestinal tract and to exert effects on the resident intestinal flora. These changes are temporary and disappeared at the end of the supplementation period.

It was shown that carefully selected co-cultures of dairy and probiotic strains could be used for a successful milk fermentation, and some strains had both
good sensory and good probiotic properties. Overall
data from the project clearly show that accurate char-
acterisation of bacterial strains results in probiotic
products with good ‘health-promoting’, organoleptic
and commercial (shelf-life) properties.
For more information contact Professor L. Morelli,
Istituto di Microbiologia, Piacenza, Italy, Fax: +39-523-
399246.

Food intolerance

Many foods contain constituents that possess
inherent biological properties; saponins, for
example, are known to affect intestinal perme-
ability. This poses the question as to whether
bioactive food constituents promote induction of
allergic reactions to food or trigger symptoms at
lower concentrations of a specific dietary allergen in
already sensitised individuals. The main objective of
this FLAIR project was to undertake experimental ani-
mal studies to elucidate the relationship between sub-
stances in foods capable of increasing the permeability
of the gastrointestinal mucosa and the development of
allergic reactions to milk proteins and other food
antigens.

A whole animal model for food allergy, the inbred
Brown Norway (BN) rat, has been established using
two different antigens i.e. semi-skimmed milk and
ovalbumin. The number of animals developing sensi-
tivity to milk proteins and the profile of antigens
recognised varied between experiments. However,
when saponin (1.5 mg/ml) was given together with
the milk, development of allergenicity was clearly
demonstrated. Thus one bioactive agent, saponin, has
been shown to promote the development of allergic
responses to dietary antigens in the experimental BN
rat model.

Preparation and purification of eight allergens from
cows’ milk have led to much improved screening of
allergic patients. Four proteins of the lactoserum
fraction, (β-lactoglobulin, α-lactalbumin, bovine serum
albumin and lactoferrin), and four proteins of the curd
fractions, (kappa-casein, β-casein, αS1 and αS2 casein)
were used in the clinical assays. The establishment of
data on the distribution and intensity of specific
responses in over 200 patients has provided an invaluable
basis for clinical and epidemiological studies on
cows’ milk allergy. For example, although lactoferrin
is present in a very low concentration in milk it was
identified as a potent allergen.

For more information contact Dr K. Miller, BIBRA
Toxicology International, Surrey, United Kingdom,
Fax: +44-1-661-7029

Dissemination:
FLAIR-FLOW EUROPE

Spreading the results from the FLAIR pro-
gramme to the food industry and health pro-
essionals is ongoing in 17 countries via FLAIR-
FLOW EUROPE, which is supported jointly by the
EU FLAIR and VALUE programmes. The latter is
located in Luxembourg and promotes the dissemina-
tion and exploitation of EU R and D results. The
results presented in this pamphlet represent only a
fraction of the total output from the FLAIR pro-
gramme, which has harnessed the best expertise in
Europe. A brief account of all 33 FLAIR projects is
contained in another pamphlet (F-FE 152/94), which is
available on request. This research effort has not
ceased with the conclusion of the FLAIR programme
far from it; it has been expanded in the ongoing suc-
cessor to FLAIR called AAIR, and will be increased
further in the FAIR programme which commences in
1995. The first call for proposals of FAIR opened on
15 December 1994 with a closing date of 15 March
1995. However, there will be a number of subse-
quently calls. The area of consumer nutrition and wellbeing
commands a prominent position in the food section of
the FAIR programme.

This article was compiled by Dr Ronan Gormley of the
FLAIR-FLOW EUROPE project in collaboration with col-
leagues in the FLAIR programme and EU officials.

For more information on EU food research and development
programmes contact Mr L. Breslin at the European
Commission, Directorate-General for Science, Research and
Development, Agri-Industrial Research (DG-XII-E-2, 2126),
Brussels. Phone: +32-2-295 0477; Fax: +32-2-296 4322 or
Dr Gormley at The National Food Centre, Dublin 15, Ireland.
Phone: +353-1-838 3222; Fax: +353-1-838 3684

For more information on the VALUE programme contact
Dr C. Gitzinger at the European Commission, Directorate-
General for Telecommunications, Information Market and
Exploitation of Research (DG XIII-D/3), Luxembourg.
Phone: +352-4301-33887; Fax: +352-4301-34179.