

Conference on ‘The ticking time bomb: the metabolic syndrome’

LIPGENE: an integrated approach to tackling the metabolic syndrome

Judith Buttriss[†] and Anne Nugent

British Nutrition Foundation, 52–54 High Holborn, London WC1V 6RQ, UK

The prevalence of obesity, overweight and type 2 diabetes are increasing in all regions of Europe. Obesity is already commonplace, affecting 10–20% of men and 10–25% of women, and by 2010 approximately 31 million of the population will require treatment for diabetes and its related complications, including the ‘metabolic syndrome’ (a cluster of cardiovascular risk factors). Associated health and social welfare costs are expected to rise to economically unsustainable levels in Europe as a direct result of these trends. Effective strategies are needed to tackle this major public health problem and to decrease dependence on medical management. These issues are the focus of LIPGENE (FOOD-CT-2003-505944), funded by the European Commission, which will investigate the interactions between dietary constituents and the genome in the development of chronic diseases, such as the metabolic syndrome, and will utilise new technologies to identify novel solutions. The LIPGENE consortium comprises twenty-five research centres across Europe. Features of the 5-year work programme include a major human nutrition intervention study in eight European cities, development of a sustainable vegetable oil product naturally rich in long-chain *n*-3 fatty acids, and identification of a protocol for feeding dairy cows that will result in milk with a more favourable fatty acid composition. Other work packages will provide a detailed economic analysis of the current and future healthcare costs associated with the metabolic syndrome, and an analysis of consumer attitudes. There is also a dissemination programme associated with the project that features conferences, workshops and associated publications.

LIPGENE: Obesity: Metabolic syndrome: Diabetes: Genetic variation

The prevalence of obesity, overweight and type 2 diabetes is increasing in all regions of Europe. Across Europe approximately 10–20% of men and 10–25% of women are obese, and prevalence is increasing (Goldberg, 2003); rates of obesity are highest in the Baltic States (Pomerleau *et al.* 2000). Furthermore, it is estimated that in Europe by 2010 approximately thirty-one million in the population will require treatment for diabetes and its related complications (Zimmet *et al.* 2001). Accompanying this increasing prevalence of obesity and diabetes is a range of associated metabolic symptoms and cardiovascular risk factors, including the so-called metabolic syndrome.

The metabolic syndrome refers to a number of strongly interrelated risk factors for CVD, i.e. obesity (particularly

abdominal obesity), abnormal blood lipids (dyslipidaemia), insulin resistance and high blood pressure (hypertension; Isomaa, 2003). The risk of developing the metabolic syndrome and type 2 diabetes increases with age, as they are chiefly diseases of middle and old age. Throughout Europe the population is living longer and the average age is increasing (Buttriss, 2003). It is estimated that by 2030 approximately 30% of Europeans will be aged ≥60 years (World Bank Atlas, 2000). Thus, it is expected that the prevalence of the metabolic syndrome will increase markedly unless effective public health strategies are enforced (see Shaw *et al.* 2005). Associated with this increased prevalence will be a dramatic increase in healthcare and social welfare costs. In the USA, an

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[†]Corresponding author: Dr Judith Buttriss, fax +44 207 404 6747, email j.buttriss@nutrition.org.uk

Table 1. Partners involved in the LIPGENE research project*

Human nutrition	
Trinity College Dublin, Dublin, Republic of Ireland	
University of Reading, Reading, Berks., UK	
University of Córdoba, Córdoba, Spain	
University of Uppsala, Uppsala, Sweden	
Unilever Health Institute, Vlaardingen, The Netherlands	
University of Bergen, Bergen, Norway	
University of Oslo, Oslo, Norway	
INSERM, France (UMR-U476 INSERM/INRA, Marseille, France; Unit INSERM U557/INRA/CNAM, Paris, France)	
Maastricht University, Maastricht, The Netherlands	
University of Krakow, Krakow, Poland	
Hitachi Europe Ltd, Dublin, Republic of Ireland	
Consumer science	
University of Porto, Porto, Portugal	
University of Ulster, Coleraine, UK	
Animal nutrition	
University of Reading, Reading, Berks., UK	
INRA, France (UR1213 INRA, St Genès-Champanelle, France; UR1154 INRA, Châtenay-Malabry, France)	
MTT Agrifood Research Finland, Jokioinen, Finland	
Rowett Research Institute, Aberdeen, UK	
Plant biotechnology	
BASF Plant Science GmbH, Ludwigshafen, Germany (two centres)	
University of York, York, UK	
Rothamsted Research, Harpenden, Herts., UK	
Dissemination	
British Nutrition Foundation, London, UK	
Economic science	
LMC International, Oxford, UK	

INSERM, Institut National de la Santé et de la Recherche Médicale; INRA, Institut National de la Recherche Agronomique; CNAM, Conservatoire National des Arts et Métiers.

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indicator of European trends, >9.4% of the US healthcare budget is spent on the treatment of obesity and its related diseases; an expenditure that is expected to increase with time (Mokdad *et al.* 2000). Health and social welfare costs associated with this disease are expected to rise to economically unsustainable levels in Europe during the early part of this century (Eurostat, 2000). Effective strategies are therefore needed to tackle the spread of this disease and to decrease dependence on medical management. Recent evidence suggests that a combination of diet and exercise are more effective than drug treatment in preventing the development of type 2 diabetes in high-risk individuals (Knowler *et al.* 2002; Mann, 2002).

With the advent of new technologies, scientific research is currently investigating the interactions between dietary constituents and the genome in the development of chronic diseases, such as the metabolic syndrome. One such programme of research is the EU-funded project, LIPGENE.

LIPGENE (contract no. FOOD-CT-2003-505944) is an integrated project of the EU Sixth Framework Programme for Research and Technology Development that is being conducted by a consortium of twenty-five research centres across Europe, encompassing fourteen countries (see Table 1). The project is entitled: Diet, genomics and the

metabolic syndrome: an integrated nutrition, agro-food, social and economic analysis. It began in February 2004 and will run for 5 years.

LIPGENE is adopting a truly integrated approach to examine the interaction of food supply and genes in the metabolic syndrome in an attempt to reduce the global tide of obesity and its complications. LIPGENE comprises six work packages, one of which (work package 6) focuses on dissemination activities to raise awareness and understanding of:

1. the need to integrate diet and genetics in tackling the metabolic syndrome;
2. the potential of agro-food technologies to combat the metabolic syndrome;
3. consumer and economic perspectives of the disease and its treatment.

As part of the dissemination programme, a conference was held in London on 1 December 2004. The papers that were presented provide the background to the LIPGENE work programme, which is organised as five major work packages. These five work packages will be summarised; further information is available at www.lipgene.tcd.ie. In addition, to set the scene for the papers on the new agro-food technologies that are being exploited in LIPGENE, the conference included a presentation on developments over the past ≥ 100 years (see Upritchard *et al.* 2005) that have enabled the development of spreads rich in unsaturated fatty acids but low in *trans*-fatty acids. Additional information on the dissemination programme, including future events, can be found at www.nutrition.org.uk/lipgene.

Work package 1 will focus on human nutrition to examine how variation in the composition of dietary fats interacts with common human genetic variations to influence the development of the metabolic syndrome (see Roche *et al.* 2005). This research will involve the analysis of existing dietary, biochemical, clinical and genetic data from 13 000 subjects (Supplementation en Vitamines et Minéraux Antioxydants Study conducted in France; www.suvimax.org) and the initiation of a comprehensive human intervention study in which dietary fatty acid profile is modified. This intervention study will involve volunteers from eight cities across Europe, using diets specially designed to suit the needs and tastes of both northern and southern European countries.

Two of the work packages (2 and 3) aim to enable greater availability of food products that can enhance human health. In particular the programme aims to generate:

1. a sustainable vegetable-oil product enriched with the dietary fatty acids naturally present in fish oil (long-chain *n*-3 PUFA, which are known to play a role in human health; work package 2; see Napier & Sayanova, 2005);
2. a protocol for feeding dairy cows (work package 3) that changes the composition of milk fat to one with less saturates, less *trans*-fatty acids and more mono-unsaturates (i.e. to one with a more favourable fatty

acid profile). In addition, the production and supply of poultry meat enriched with long-chain *n*-3 PUFA will be examined (Givens, 2005).

Work package 4 involves a detailed economic analysis of the current and predicted future healthcare costs of the metabolic syndrome across the EU. In addition, it will assess the economic implications of altering the composition of dietary fat, as a means to reduce the economic burden associated with the metabolic syndrome, and will also compare the implications of pharmacological *v.* population nutrition interventions as a means to tackle the metabolic syndrome (Fry & Finley, 2005).

A quantitative and qualitative analysis of consumer attitudes to the metabolic syndrome, the new agro-food technologies and the use of genomics in personalised nutrition will form the basis of work package 5. Focus groups will be used to explore consumer awareness and information needs relating to the metabolic syndrome. Using a specifically-developed and validated psychometric tool across six countries it is hoped to identify a 'model' of food habits, psychological factors and risk factors for the metabolic syndrome (Stewart-Knox, 2005).

LIPGENE will also include a demonstration project, in due course, coordinated by the Unilever Health Institute (Vlaardingen, The Netherlands).

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