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PROJECT EXAMPLES

# The fight against obesity

Examples of EU projects in the field of nutrition and obesity

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# The fight against obesity

**Examples of EU projects in the field of nutrition and obesity**

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## INTRODUCTION

The world is currently facing two contradictory major nutritional problems: 600 million people face starvation whilst at the same time 310 million people face the problem of obesity.

Obesity is now a major public health issue for many industrialised nations around the world as there is an alarming increase in the prevalence of overweight and obesity over recent decades. According to the European Association for the Study of Obesity, almost a third of people living in the European Union are overweight and more than one in ten is now clinically obese. The groups causing greatest concern and for which the consequences may be particularly severe are children and adolescents. It is estimated that 14 million children are overweight, including 3 million who are obese, and this figure is rising at more than 400.000 a year, affecting almost 1 in 4 across the 25 European Member States.

While obesity is itself an avoidable chronic disorder, the health consequences of obesity and overweight are many and varied, ranging from an increased risk of premature death to non-fatal but debilitating conditions to psychological complaints that have an adverse effect on quality of life. The most significant health consequences associated with obesity and overweight are: type 2 diabetes, cardiovascular diseases and hypertension, respiratory diseases (sleep apnoea syndrome), some cancers, osteoarthritis, psychological problems and a decrease in perceived quality of life. A dramatic rise in the incidence of type 2 diabetes in children and adolescents has been detected in recent years. This is largely due to the fact that a progressive number of children are becoming overweight and obese, which is generally caused by a lack of physical activity (television, computer, and video games) combined with unhealthy eating patterns.

In the last decades, food has become so abundant in Europe and other parts of the industrialised world that, coupled with our increasingly sedentary lifestyles, rapid cultural changes, increasing urbanisation and massive dietary changes, obesity is becoming one of the most serious public health issues facing the EU.

The medical costs of obesity pose a huge and growing financial burden on national resources. It has been estimated to account for between 2 and 8 % of total healthcare costs in Western countries or 70 to 130 million € in the EU. These alarming figures have led national governments and the European Commission to devote an increasing level of resources to extend existing initiatives or launch new actions designed to reverse the obesity trend. Combating obesity will require long term multiple strategies to be put in place and the combined efforts of many sectors.

The active participation of many stakeholders (including governments, researchers, health professionals, retailers, consumer representatives and the media as well as the food industry) is necessary to efficiently address the problem.

The European scientific community, one of the key actors, is working hard in this area to find solutions to this emerging problem. In the last few years, advances in basic research have increased our understanding of the body weight control system at the molecular level, paving the way for new methods of obesity control. However, many aspects of energy metabolism and of the functions of the adipose organ which is a key player in the general metabolic regulation still need to be further understood. Although influenced by genetic traits, the current obesity epidemic is strongly caused by environmental factors such as lifestyles, diet and physical activity. There is a need of more knowledge on the precise factors that promote obesity. A better knowledge of them will provide the basis for preventive public health measure to efficiently counteract the increasing prevalence of obesity

A total of 10 projects have been funded in both FP5 and FP6 with an EU contribution of 61 € millions. This brochure gives an overview of the projects financed under FP5 within the Key Action “Food, Nutrition and health” of the “Quality of life and management of living resources” programme and under FP6 within the “Food quality and safety” Priority in the area of nutrition and obesity.

Christian Patermann  
Directorate-General for Research  
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Brussels, August 2005

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# **NUGENOB – Nutrient-Gene interaction in Human Obesity**

## **QLK1-2000-00618**

**Coordinator: Thorkild IA Sørensen, Institute of Preventive Medicine, Copenhagen University Hospital, DK.**

**Project Website: [www.nugenob.org](http://www.nugenob.org)**

### **Project Work**

The objective of the project is to improve understanding of the role of interaction between nutrition, especially fat intake, and genetic variations in obesity, which may be the basis for revision of dietary guidelines. Obese and lean subjects (771 and 119) had a high-fat test meal and measures of energy expenditure and fat oxidation were obtained before and after the meal, together with measures of the concentration of metabolites and hormones in the blood. The obese subjects underwent a 10-week weight loss randomised intervention with either moderate or low fat content, but same reduction in energy intake (- 600 kcal/day). In all subjects a blood sample was obtained for genotyping. In a subgroup of the obese subjects the activity of specific genes in fat tissue were examined before and after the weight loss intervention.

### **Major Results**

The dietary fat energy percent was 25% in the low-fat group and 40% in the high-fat group, and the average weight loss was 6.9 kg and 6.6 kg in these groups, respectively. Dropout was higher in the high-fat group than in the low-fat group (18% versus 14%). Among completers, more subjects lost >10% in the low than in the high-fat group (21% versus 15%). Fasting plasma total, LDL, and HDL-cholesterol decreased in both groups, but more so in the low-fat group. Fasting plasma insulin and glucose were lowered equally by both diets. Levels of mRNA of 10 out of the 38 genes, investigated in subcutaneous adipose tissue in a subset of patients examined before and after the diets in two groups, were regulated by energy restriction, but none of the genes showed a different response to the diets. Clustering analysis revealed new potential co-regulation of genes. In another series adipose tissue m-RNA samples were hybridized to micro-arrays containing the 8500 most extensively described human genes. A total of 52 genes were significantly up-regulated and 44 were down-regulated as a result of the intervention, and no diet-specific effects were observed. Thus, macronutrients may have a secondary role in changes in adipocyte gene expression after energy-restricted diets. A number of obesity-related candidate genes have been identified (some as part of the project, see the website) and genotyped for potentially important genetic variation and analysis of their role in the diet-induced weight change is currently being analysed.

## **NUTRIX: Early malnutrition and programming of adult degenerative diseases: experimental, epidemiological and preventive studies - QLK1-2000-00083**

**Coordinator: Claude Remacle, Institute of Life Science, Université Catholique de Louvain, Louvain-la-Neuve, Belgium**

**Website: <http://www.nutrix.be>**

### **Project Work**

Epidemiological studies have suggested that foetal growth retardation as well as rapid postnatal childhood weight gain (catch-up growth) were related to the subsequent development of glucose intolerance, insulin resistance, obesity, hypertension and cardiovascular disease in adult life. To explain this association, it has been proposed that foetal malnutrition programs the metabolism in a manner beneficial to survive under environment of poor postnatal nutrition. This would give rise to a thrifty phenotype, which would become detrimental if the foetus was born in conditions of either adequate or over-nutrition. The mechanisms underlying the impact of early malnutrition on the development of obesity are still unclear. Therefore, in the NUTRIX program, we aimed to highlight how adverse intrauterine or postnatal conditions lead to the programming of obesity in adulthood.

### **Major Results**

Two models of malnutrition in rat were compared: protein and calorie restriction (50% of *ad libitum* intake). Our results demonstrated that protein restriction during gestation and lactation led to permanent growth retardation. In such offspring, there was no clue in favour of an early programming of obesity even when they were challenged with a hypercaloric diet. Food intake was similar between control and low protein animals, suggesting that there was no programming of appetite by early malnutrition.

By contrast, overfeeding during the suckling period induced a rapid catch-up growth in offspring previously submitted to protein or calorie restriction during foetal life. This effect was amplified with time as well as hypercaloric feeding, and at adult age, such restricted offspring were heavier than control animals. Interestingly, calorie-restricted pups developed intra-abdominal obesity even without the hypercaloric diet challenge. This phenotype was not observed after foetal protein deprivation, and it suggests that foetal calorie but not protein restriction led to the programming of adult obesity in offspring presenting a postnatal catch-up growth. There was no difference of appetite regulation between groups. On the other hand, adipose tissue expresses several factors implicated in hypertension and cardiovascular disease development. We found that early malnutrition could alter the gene expression of such factors in adipose tissue, which should participate to the development of cardiovascular disease.

In conclusion, we demonstrated that postnatal overfeeding after foetal protein or calorie malnutrition leading to growth retardation induced a rapid catch-up growth and favoured the development of obesity and its associated metabolic disorders in adult life. The relevance of such findings in human has to be considered.

# **LIPGENE: Diet, genomics and the metabolic syndrome: an integrated agro-food, social and economic analysis – FOOD-CT-2003-505944**

**Coordinator: Mike Gibney, Trinity College Dublin, Ireland**

**Website: [www.lipgene.tcd.ie](http://www.lipgene.tcd.ie)**

## **Project work**

This multi-disciplinary project is centred around ascertaining the extent to which changes in the composition of dietary fat influences one of the main the adverse effects of obesity, insulin resistance and to ascertain the extent to which this process is influenced by genetic variation. This will involve exploiting existing databases comparing cases who over time developed these complications of obesity with controls who, over the same time remained healthy and seeing how dietary and genetic variation interact in shaping the advent or otherwise of insulin resistance. This hypothesis will also be investigated in a multi-centre study across 8 cities and involving 480 subjects who will follow one of four experimental diets varying in fat level and composition for 12 weeks. Surrounding this core lies a second stream in the natural sciences. One is investigating how new animal feeding technologies can help improve the nutritional properties of dairy and meat fat and a second is attempting to endow land oilseed crops with the metabolic pathway from algae that is responsible for synthesising long chain polyunsaturated fatty acids through genetic engineering. The socio-economic sciences are involved. A major review of consumer attitudes to the problem of obesity is being conducted which will also explore the extent to which the general public will embrace new agro-food technologies to improve the nutritional properties of dietary fats. A second project in the socio-economic area is an investigation of (a) the economic costs of preserving the identity of food produced using the new agro-food technologies through the entire food chain and (b) the direct and indirect economic costs of the complications of obesity. Finally, throughout the project an active communication programme will be pursued which will lead finally to a demonstration of the possibilities for altering the fatty acid composition of everyday foods using the technologies developed during the project.

## **Expected results**

The main results from this study will not start flowing until 2007 and onwards.

LIPGENE will contribute to the following to the following expected results:

- Understanding the interaction of diet and genotype on the risk of developing disorders of the metabolic syndrome.
- Studying the mechanisms of the action of dietary fats on the metabolic pathways underlying the metabolic syndrome.
- Evaluating the capacity of genetic engineering to produce varieties of oilseeds capable of expressing variable fatty acid compositions.
- Production of milk fat containing lower levels of saturated fatty acids and increased amounts of cis-MUFA, in the absence of substantial increases in trans fatty content.
- Production of non-ruminant meat enriched with long-chain n-3 fatty acids but with satisfactory oxidative stability and taste.

- Studying of European consumer attitudes in six EU countries to the genetically modified food and to individual genotyping to optimise nutrient intakes.
- Economic analysis of the health costs of the metabolic syndrome and of the costs of restructuring agricultural support to modify the fatty acid composition of the EU diet.
- A demonstration of how technologically modified fats can be included in foods and routes by which the benefits of these modifications can be communicated effectively to target consumers.

## **BIOCLA: Production of CLA-enriched dairy products by natural means - QLK1-2002-02362**

**Coordinator: C. Stanton, Teagasc Biotechnology Centre, Moorepark, Fermoy, Cork, Ireland.**

**Website: <http://www.teagasc.ie/research/dprc/biocl/>**

### **Project Work**

Whole milk contains approximately 3.5% fat, which is made up of a complex group of over 400 fatty acids. One fatty acid found in relative abundance in milk is conjugated linoleic acid (CLA), which has been shown to exhibit several health promoting attributes, including protection against cancer, heart disease and obesity. These diet-related diseases contribute significantly to EU health-care costs. CLA arises in milk as a result of microbial biohydrogenation in the rumen, and is produced directly as an intermediate during the microbial biohydrogenation of dietary linoleic acid, and endogenously from *trans*-vaccenic (*trans*-11-C<sub>18:1</sub>) acid in mammary tissue. The ruminant animal diet influences the production of CLA and *trans* fatty acids in milk, and the fatty acid spectrum of milk can be modified through animal nutrition. To confer the potential benefits of CLA to humans, CLA rich foods should be included as part of a balanced diet.

The objectives of this project were to develop dairy-based functional foods enriched in conjugated linoleic acid (CLA), through animal nutrition and management strategies developed for production of CLA enriched milk, and by exploitation of CLA producing food cultures, and evaluation of product efficacy in human clinical trials.

### **Expected Results**

The approaches taken involved co-ordinated studies of CLA metabolism and behaviour in milk production in bovine, ovine and caprine species, leading to development of natural, consumer-acceptable strategies and processing systems to produce CLA-enhanced dairy foods of proven safety and quality. Fresh pasture intake in conjunction with dietary supplementation with novel dietary supplements developed using specific technology for the manufacture of extruded feedstuffs with very high content in polyunsaturated fatty acids, from raw material and mixes proved successful for modification of the fatty acid profile of milk of dairy cows, sheep and goats, towards a more 'healthy' composition, with "enhanced" concentrations of *cis9*, *trans11* CLA. As a result, a number of cheese varieties have been developed using this milk, and the quality, stability and sensory aspects optimised prior to scale-up of the process for production of cheese for human clinical evaluation. These human trials are now on-going, in an effort to establish the safety and efficacy of CLA enriched cheeses compared to controls at enhancing the CLA status of humans, as well as other health parameters, and the contribution of other milk fatty acids, notably vaccenic acid to human CLA status in placebo-controlled clinical trials. In parallel, ongoing studies are aimed at exploitation of CLA producing probiotic cultures for stable incorporation into functional foods, and ongoing human studies are addressing whether these CLA enriched dairy products are beneficial to humans.

This project has led to advances in the identification and enrichment of particular dietary components with demonstrated health benefits in milk and dairy products, and these innovations will enhance the nutritional content of dairy foods, via manipulation of bovine milk fat by animal diet at farm level and the exploitation of dairy foods as carriers of probiotic cultures.

# **EU CHILDOOD OBESITY: Childhood Obesity Programming by Infant Nutrition - QLK1-2001-00389**

**Coordinator: Berthold Viktor Koletzko, Dr von Hauner Children's Hospital, University of Munich, Germany**

**Website: [www.childhood-obesity.org](http://www.childhood-obesity.org)**

## **Project Work**

The key objective of this randomised double-blind multicentre clinical trial is to test the influence on growth (i.e. increase of length and weight) of protein content of infant formula fed during the first two years of life. **High growth rates were shown to be an early marker of later obesity risk** A secondary objective is to compare effects of different habitual protein intakes with traditional complementary feeding regimes in infants across 5 European countries (Germany, Belgium, Italy, Poland and Spain). The influence of these infant feeding regimes on body composition, energy expenditure, protein metabolism, renal function and size, leptin, its binding protein and insulin-like growth factor-I will be examined. Further objectives are to explore other early determinants of obesity as well as consumer attitudes and infant feeding practices in relation to parental obesity status. The possible correlation between diet and later growth via biochemical parameters in plasma at the age of 6 months will be investigated. Information on infant behaviour (crying, sleeping and feeding behaviour) will be obtained to quantify their relationship to the development of obesity. The evolution of growth of two formula fed study groups will be compared to a reference cohort of breastfed infants. Effects of different dietary regimes on total energy expenditure will be analysed and the relationships between total energy expenditure, body composition and obesity risk will be obtained.

## **Expected Results**

An intervention trial will compare two infant formulae and follow-on with high (12 and 18 % of energy, respectively) and low (7 and 9 of energy, respectively) amounts of milk protein. The difference in protein content is compensated for by adaptation of fat content. Overall protein quality and fatty acid profiles are similar in the two experimental formulae. The composition of all study formulae complies with guidelines of the 1991 EU Directive on Infant Follow-on Formulae. A selection of the most appropriate anthropometric measurements has been chosen in order to evaluate the relationship between infant feeding and anthropometric markers of future obesity. The total number of children recruited within the scope of the EU Childhood Obesity Programme was 1791, 1152 formula fed and 639 breastfed of whom 842 and 346 children respectively were still remaining for follow up. During the further course of the study dropout rates will be monitored by monthly status reports. Unblinding and statistical analysis will take place in 2006.

The expected achievements are:

- Conclusive information on whether a high protein intake in infancy is causally related to early markers of obesity risk

- Improved health and quality of life by preventing childhood obesity in developing new infant foods (formula and complementary foods) with adequate protein content
- A better understanding of the dietary and other factors in early life influencing body composition and energy expenditure
- A better understanding of consumer (parental ) attitudes to infant feeding.
- Conclusive information on whether breastfeeding confer a long-term preventive effect on obesity risk in later life

# **FACTORS IN HEALTHY EATING: The role of social, genetic and environmental factors in healthy eating: a multi-centre analysis of eating disorders and obesity - QLK1-1999-00916**

**Coordinator: Professors David Collier and Janet Treasure, Institute of Psychiatry, Division of Psychiatry, Eating Disorders Unit, UK**

**Website: <http://www.eatingresearch.com>**

## **Project work**

The aetiology of the eating disorders anorexia nervosa, bulimia nervosa and obesity is poorly understood, and this has hampered efforts at treatment and prevention. The research project was aimed at furthering our understanding of these disorders. The research was composed of three overlapping areas, research into the psychosocial environment, the human genome and the function of the brain, all of which examine distinct and shared risk factors and characteristics underlying the aetiology of eating disorders.

## **Major results**

The main outcome of the project was to create aetiological model of these disorders. We found that patients who develop eating disorder have a set of identified psychosocial risk factors together with genetic vulnerability which together lead to the illness, and can be recognised by specific changes in cognitive and performance and brain function which has relevance to eating behaviour.

The most significant achievements of the project are as follows:

Development of research instruments in multiple European languages for identification of risk factors and diagnosis including the EATATE (diagnostic) interview and the RIFAI (risk factor) interview, now used widely in the EU and USA.

We identified risk and protective factors in families, including personal and environmental factors such as abuse and perfectionistic personality.

We identified dieting behaviour in adolescents related to adverse psychosocial factors such as abuse, and health-compromising behaviours.

We found that changes in eating behaviour, stress in school, exercise, smoking, physical disease, and further diets are all perceived as relevant to weight loss by young obese patients.

We discovered cultural differences in attitudes to food, such as family mealtimes and use of food as reward and punishment that are relevant to the development of eating disorders.

We discovered that males with eating disorders have similar characteristics to females but higher rates of premorbid obesity and overweight.

We used Principal Component Analysis to develop prototype clusters for anorexia, bulimia and binge eating disorder.

We identified the brain derived neurotrophic factor gene (BDNF) as a probable risk factor for eating disorders, in addition to analysing 13 different candidate susceptibility genes in the project.

We performed advanced genetic analysis of haplotypes and gene-environment interaction in discordant sister pairs, focussing on the 5-HT2A gene.

We used neuroimaging techniques to show that medial prefrontal cortex activity is associated with symptom provocation in eating disorders

Over 16 scientific publications have arisen so far from the project, with a similar number in preparation or in press, and the results have been disseminated to other academics through traditional means, to healthcare professional, and patients and the public through user groups, newsletters and the general media.

# **DIET AND OBESITY: Dietary and genetic influences on susceptibility or resistance to weight gain on a high fat diet - QLK1-2000-00515**

**Coordinator: Julian Mercer, Rowett Research Institute, Aberdeen, UK**

**Website: [www.euroobesity.org](http://www.euroobesity.org)**

## **Project work**

The overall objective of this project was to identify the causes of weight gain in the human population on a Western, energy dense, high fat diet through description of genetic background and phenotypic traits (behavioural, metabolic, physiological, psychological) associated with dietary preference and relative susceptibility or resistance to weight gain and obesity. Studies of the mechanisms underlying susceptibility to diet-induced obesity (DIO), and responses to fattening diets utilised a rodent model. The project also addressed the effect of early life nutrition on dietary preferences, susceptibility to obesity, and activity of hypothalamic (brain) neuroendocrine systems involved in energy balance.

## **Major Results**

The prevalence of high fat (HF) and low fat (LF) consumers was established, and phenotypes associated with susceptibility to weight gain and obesity were characterised. DIO -resistant and -susceptible phenotypes were rare within the sample population, with a prevalence of 2-5%. Characterisation involved assessment of attitudes, diet and lifestyle, physical, non-invasive measures, heart rate, activity, motivation to eat, and indirect calorimetry (energy and nutrient metabolism). Subjects susceptible to DIO were older, more restrained, and showed greater hedonic responses to foods, and a weaker effect on satiety when fed a HF diet. Susceptible individuals appeared aware and concerned about weight gain. The relatively infrequent HF consumer who is susceptible or resistant to DIO sits at the extreme end of a normal distribution. The number of individuals for whom detailed dietary information could be obtained, and to whom a clear phenotype could be ascribed, was restricted, resulting in small sample sizes that limited the power of molecular genetic candidate gene studies investigating the involvement of genetic variants in food preferences and susceptibility to obesity on a HF diet. The Sprague-Dawley (SD) rat model of DIO exhibited a normally distributed range of body weight trajectories when fed a high energy diet, making the model a good representation of the majority of human which is multifactorial and polygenic in nature. The quality of nutrition in early life (the diet ingested by mothers during pre- and early postnatal periods) was important for the development of signalling pathways participating in the regulation of feeding behaviour. These effects may be long-lasting or permanent, including enhancement of the obesogenic potential of diets presented in adult life. The critical period for nutritional influence on key hypothalamic systems appeared to be gestation rather than lactation. A multi-lingual web-site (<http://www.euroobesity.org>) was established targeted specifically at a lay rather than an academic audience and designed to be appealing to all age groups, but particularly children and adolescents.



**EARNEST: Early Nutrition Programming of Adult Health  
Long term follow up of efficacy and safety trials and integrated  
epidemiological, genetic, animal, consumer and economic research  
– FOOD-CT-2005-007036**

**Co-ordinator: Berthold Viktor Koletzko, Dr von Hauner Children's Hospital, University of Munich, Germany**

**Website: [www.metabolic-programming.org](http://www.metabolic-programming.org)**

### **Project Work**

Nutrition in the womb and in infancy influences or 'programmes' the development and health of the child, with these influences extending well into adulthood and old age. Observational and clinical studies and long-term follow up in humans, as well as lifetime studies in animals, all point to the influence of early nutrition programming.

What is not yet clearly understood is precisely how important and extensive that programming is to increasing the risk in adulthood of becoming obese, or developing one of the major life-limiting conditions such as diabetes, cardiovascular disease, cancer or mental illness.

Neither can we yet explain the precise mechanism of this programming, or identify whether its timing is critical. Most importantly we do not yet know whether such programming can be modified or even reversed.

The EARNEST project, with its nine integrated themes, will improve our understanding of early nutrition programming, based on robust inter-disciplinary research from the follow up of clinical trials, epidemiology, genetic work and consumer science. Teams involved with commercial development, economic modelling and dissemination to a wide group of interested parties will allow the project to test the practicality and applicability of its findings for governments, NGOs and commercial operations.

### **Expected results**

The objective of the EARNEST project is to reduce the incidence of adult diseases that have their origins in the nutritional intake encountered in the womb and in early childhood. Obesity, diabetes, cardiovascular disease, cancers and cognitive and mental disorders may all be influenced by such early nutritional programming.

Through its integrated approach, EARNEST will provide evidence that will lead to the creation of robust and effective public health policy and practice, thus ensuring that more individuals enjoy full health for longer.



## **HELENA: Healthy Lifestyle in Europe by Nutrition in Adolescence – FOOD-CT-2005-007034**

**Coordinator:** Luis A. Moreno, E.U. Ciencias de la Salud, Universidad de Zaragoza, Zaragoza, Spain

**Website:** <http://www.helenastudy.com>

Adolescence is a crucial period in life and implies changes that affect nutritional needs and habits. Healthy (or unhealthy) life-long habits begin there. Many non-communicable diseases, like obesity, are thought to have their origins in this period of life. The key to health promotion and disease prevention in the 21<sup>st</sup> century is to establish an environment that supports positive health behaviour and healthy lifestyle.

### **Project Work**

HELENA study is designed to understand and effectively enhance nutritional and lifestyle habits of adolescents in Europe. One of the strengths and innovative aspects of the project is the use of a common methodology that will result in reliable and comparable data between the countries. During the 3 years of the HELENA study, three main objectives will be attained. In the first place, the nutritional status of European adolescents between 13 and 16 years of age will be assessed through cross-sectional studies in the different countries. Secondly, a Lifestyle Education Programme aiming at improving eating and lifestyle habits of this population segment will be developed and tested. And finally, in collaboration with the industry partners of the project, and based on the knowledge gathered on adolescent food choice and preference, healthy foods that are appealing to adolescents will be developed.

### **Expected Results**

The major results we expect to have with HELENA are the following:

- New innovative methods to assess diet, nutrition, and physical activity and fitness in adolescents of different European countries.
- Increased knowledge about dietary and physical activity patterns in European adolescents and about cultural, social, genetic and gender differences and similarities across Europe.
- Better insight about the factors influencing the food choices and food preferences of adolescents in Europe.
- Better identification of adolescents at risk of eating disorders (like anorexia or bulimia), obesity and/or type 2 diabetes.
- Improvement of European adolescent's diet through the development of healthy foods that are appealing to this population group and through a computer-based education tool.



## **DIOGENES: Diet, Obesity and Genes – FOOD-CT-2005-513646**

**Coordinator: Wim H.M. Saris MD PhD Nutrition and Toxicology Research Institute – NUTRIM- University of Maastricht, NL**

**Website: [www.diogenes-eu.org](http://www.diogenes-eu.org)**

### **Project Work**

This pan –European project targets the obesity problem from a dietary perspective and seeking new insights and new routes to prevention.

The five year programme, started in January 2005, involves a consortium of 29 partners across Europe. It is made up of world-class centres in diet-and –health studies, epidemiology, dietary genomics and food technology. It also includes 3 major food industrials and 5 small- and Medium-sized Enterprises (SMEs)

The primary focus of DiOGenes is an investigation of dietary macronutrient components that will facilitate the prevention of weight gain and regain, studying specifically the role of the Glycaemic Index (GI) of carbohydrate and of a high dietary protein content for enhancing satiety. The objective is to examine interactions between the dietary components and genetic and behaviour factors. With access to large long term prospective cohorts across Europe with hard clinical and nutritional data, DiOGenes has a unique opportunity to identify gene-nutrient interactions associated with changes in body weight and waist circumference. To examine critically the mechanistic impact of changes in macronutrient composition on weight control, a large long-term randomised, parallel dietary intervention study including whole families with both obese and normal weight members in 8 different countries across Europe will take place. Large scale longitudinal analysis of genetic variation in candidate genes as well as novel approaches such as gene expression in fat tissue and plasma peptidomics gives the opportunity to identify sets of DNA polymorphisms, adipose tissue mRNA's and plasma peptides ultimately enabling the prediction of an individual's response to nutrients in terms of weight change, which will in turn guide a diet-based treatment. Uniquely, the epidemiological and intervention studies will be flanked and supported by detailed analysis of the psychological/behavioural responses of subjects. The consortium will identify key psychological/behavioural predictors of weight gain given a genetic susceptibility, for use in diagnosing risk of weight gain and for better matching diets to consumer needs. Food technology also plays an important role. DiOGenes includes food technology studies to develop food characterised by consumer liking and preferences but at the same time by enhanced satiety signals that limits intake. This requires a combination of skills and disciplines seldom found in industry and science. A major dissemination programme will target consumers, opinion formers, the food industry and SMEs.

### **Expected results**

- The relative efficacy of different diets varying in protein content and carbohydrate Glycemic Index in preventing weight gain, regain and co-morbidities.
- Genomics-based predictors of weight variation, and biomarkers of nutritional status.

- Epidemiological identification of key dietary factors influencing development of obesity, and risk of co-morbidities, across Europe.
- A new set of psycho/behaviour tools to identify predictors of weight (re)-gain.
- A multi-lingual, software-based, obesity risk and behavioural advice screening tool (ORBAST).
- Identification of novel food ingredient systems, which induce satiety or satiation while remaining in the preferred sensory range

European Commission

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Obesity is now a major public health issue for many industrialised nations around the world as there is an alarming increase in the prevalence of overweight and obesity over recent decades. According to the European Association for the Study of Obesity, almost a third of people living in the European Union are overweight and more than one in ten is now clinically obese.

A number of projects related to this issue have been funded in FP5, within Key Action 1 “Food, nutrition and health”, Quality of Life Programme and in FP6, within Priority 5 “Food Quality and Safety”.

The objective of this brochure is to disseminate the preliminary or final results of the projects funded in the research area “Nutrition and Obesity” and to contribute, together with other Directorates-General of the European Commission, to help identifying solutions to this emerging problem.