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# European Symposium on Healthy Ageing: The Role of Food, Nutrition and Lifestyle (with Outcomes of the Nutri-Senex Project)

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**Abstracts**

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Guest Editor  
*Heinz Freisling, Vienna*

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### Getting Older, Facts about a Biological Process

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#### A1

#### Body Composition and Dietary Requirements of the Elderly

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Age has an important impact on body composition. The decreases of lean body mass and total body water accompanied by an increase of body fat are the most relevant changes leading to a reduction of the basal metabolic rate by about 2% per decade of age as compared to young adulthood. Due to this and the fact that elderly people are generally less physically active, energy needs are lower. However, the requirements for most micronutrients are not reduced. Indeed, impaired absorption of some vitamins and minerals like cobalamin and calcium can cause deficiencies. An adequate calcium supply is particularly important as with ongoing age, bone mass decreases as well, making elderly prone to osteoporosis. The reduced ability to synthesize vitamin D and the lower sunlight exposure of many elderly further aggravate this issue.

There is evidence to consider the supply of some important dietary antioxidants as critical in some elderly, namely vitamin C and  $\beta$ -carotene as well as zinc. In light of age-related decreases in the activities of antioxidant enzymes, a sufficient supply of dietary antioxidants is important, especially as oxidative damage is thought to contribute to the deteriorating processes associated with ageing and promote cardiovascular disease, cognitive disorders, cancer and diabetes mellitus that occur more frequently in older people. The first three are also associated with an insufficiency of folate, another critical nutrient in the elderly. Therefore, dietary guidelines should strive to optimize the immune function and reduce disease risk of the elderly.

In addition to the modified requirements for some nutrients and energy, physiological changes can affect the taste and smell and impede chewing, swallowing and digestion so that food for aged people not only needs to be nutrient-dense (meaning that they have a good nutrient/energy-ratio), but also palatable and enjoyable.

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#### A2

#### Gender Specific Differences during Aging

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While the aging process in women is characterized by menopause and dramatic endocrine changes, corresponding hormonal aging processes in men gradually take place with slow changes over a longer period of time, which occasionally is described as andropause. This leads to tremendous differences in the personal perception of the aging process within the different sexes.

Looking at life expectancy, the increased average life span of women, as compared to men, has been recognized in different societies throughout the last century.

This can be explained by an excess mortality of male new born and infants and of young male adults due to accidents and suicides. Differences in mortality in middle-aged men may be explained primarily by life style factors like cigarette smoking and alcohol consumption.

It needs to be mentioned that increased life expectancy in women is a phenomenon observed only in the last two centuries. Before mortality connected with the risks of pregnancy and delivery caused an excess mortality in younger women. Changes in female life styles during the last decades showed a tendency to narrowing the differences in life span between male and female in some Western countries. Moreover the gain in years for women very often means also a plus in morbidity. Apart from sex gender aging can also be seen in measuring health status and life expectancy of different social groups. Most strikingly the educational status appears to be associated with life expectancy – The higher the education the longer the expected life span.

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#### A3

#### Chemoreception and Aging: What Happens in the Brain?

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Brain development implies cell growth with peaks at different ages according to brain areas, and also cell death or synapse elimination associated with learning. The normal aging process implies a slow neuronal loss from early adulthood to senescence. Cell loss is

observed in the adult olfactory epithelium and olfactory bulb, and alike olfactory function declines with age. Moreover, the temporal and frontal areas including the primary and secondary olfactory cortices deteriorate first with age.

Plasticity and neurogenesis are nevertheless present in olfactory structures throughout life. We review data in rodents and in humans showing how alterations in the aging brain may be partly compensated by functional changes, the importance of sensory and social environment, and which sensory or cognitive abilities are better maintained in the old age. Results of a survey involving 1,300 subjects from 20 to 90 years of age in 6 European countries highlight some relationships between chemical senses capacities and quality of life in this population.

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#### A4

### Ageing, Disability and Frailty

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Despite multiple and often overlapping definitions of disability and frailty, both are common clinical characteristics of aged individuals though not identical. Geriatric syndrome of frailty is described as status of global impairment of physiological reserves involving multiple organ systems. The clinical correlate of frailty manifests as increased vulnerability, impaired capability to withstand intrinsic and environmental stressors and, limited capacity to maintain physiological and psychosocial homeostasis. Geriatric frailty is found in 20–30% elderly population over 75 years and increases with advancing age. It was reported to be associated with long-term adverse health-related outcomes: increased risk of geriatric syndromes, loss of self sufficiency, disability, mortality, hospitalization and institutional placement. Clinical phenotype of frailty manifests as multisystem pathologies characterized by low physical activity, global weakness with low muscle strength, fatigability/exhaustion, overall slowness particularly of gait, loss of weight, decreasing height in women among others. These above mentioned clinical symptoms could be explained by (or related to) some ‘pre-clinical’ diagnoses as sarcopenia, osteopenia, non-specific balance disorders, nutritional problems and overall deconditioning. More recent studies found frailty clinical phenotype to be associated with pathologic laboratory biological markers (IL-6, CRP, factor VIII, IGF-1, DHEA, cortisol, d-dimers, TNF), which suggest possible pathogenetic pathways involving pro-coagulation and pro-inflammatory status, glucose intolerance etc. We will present current recommendation for diagnosis and treatment of frailty and a WHO model of functional capacity and discuss primary and secondary prevention measures to prevent and/or postpone disability.

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#### A5

### Intestinal Microflora Functions and Elderly

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The growing healthy ageing population in Europe is a heterogeneous group with varying nutritional needs, especially in association with problems like decreased sense of smell and taste, decreased saliva production, chewing and swallowing problems besides all disease problems that put specific demands on dietary intake. Thus, the most modifiable lifestyle factors are diet and physical activity. Poor nutrition, once thought to be part of the normal aging process is, in fact, identifiable, preventable, and reversible, and should be handled before diseases are manifested.

Our group is studying microbial intestinal functions in health and disease. We evaluate *what have the flora done*, as some functions associated to intestinal microbes are difficult to isolate or otherwise detect. By this way we have possibilities to evaluate the role of endogenous and exogenous substances – the cross-talk – between the host and the flora.

To investigate this, one must clarify which functions are related to the host and which are related to the microflora itself. In short, the host's side of the ecosystem can be defined as Milieu Interieur (MI), the non-host side as Milieu Extérieur (ME) and MI plus ME together as Milieu Total (MT). When baselines in MI are established, the normal functions of the flora as well as alterations in these functions can be worked out by applying the so-called MAC/GAC concept. A Microflora-Associated Characteristic (MAC) has been defined as the recording of any anatomical structure, physiological, biochemical or immunological function that has been influenced by the microflora. When active microbes that actually influence the parameter under study are absent as in germfree animals, healthy newborns and sometimes following antimicrobial therapy – the particular recording is termed Germfree Animal Characteristic (GAC). In this lecture, I will concentrate on the microbial conversion of intestinal *cholesterol* to *coprostanol*, aiming to investigate the hepatic – intestinal flora co-cross talk.

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### Behavioural Aspects, Food and Nutrition in Later Life

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#### A6

### Changes in Food Preferences during Ageing

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The group of the elderly is very heterogeneous, covering a broad span from young and fit older persons to very old and ill people. They

present diverse target groups for the food industry and build a growing segment for marketing in most industrialised countries.

Due to the increasing ageing process in the European Union the knowledge of health and nutritional status, nutrition behaviour and food preferences might help to improve the quality of life in the third and fourth lifespan.

When growing older a lot of factors influence food preferences, like changes in the chemosensory perceptual systems, illnesses, bad oral conditions etc. However, lifestyle, socio-economic situation and other social and psychological variables may limit the influence of physiological changes and help to maintain an adequate food intake.

Empirical studies show that 'young' older people in industrialised countries are interested in adopting new trends like wellness-, fitness- or 50plus-products. If they can experience a significant effect on health and wellbeing, this target group is interested in changing food preferences and purchasing innovative products, which they often can afford because of their good socio-economic conditions.

A better understanding of the factors that contribute to modified food preferences during ageing could increase the development of appropriate strategies to improve the quality of life of people living in the third and fourth lifespan. The demographic changes of European countries make it more and more important to take into account the needs, wishes and problems of this target group.

Although there are national surveys (e.g. German National Nutrition Study I/II) which show tendencies in the field of nutritional and health status of the elderly, only few studies exist dealing explicit with socio-cultural aspects of food preferences for older people.

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## A7

### Quality of Life, Food Choice and Meal Patterns

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Quality of life is defined as the result of combining personal resources, control of the environment, personal values and actual living conditions.

Good nutrition is an important condition for quality of life, health and well-being.

During the course of life everyone develops his very individual biography of eating. This includes eating habits, food choice and meal patterns.

The process of ageing is accompanied by hardly recognizable physiological, emotional, social and environmental changes.

#### Physiological changes:

The feeling of hunger is reduced

The feeling of thirst is less perceived

The feeling of saturation is reduced

Less appetite depending on changes in taste and smell

Medicational influences on appetite and eating behaviour

#### Emotional and social changes:

Pleasure and enjoyment of food is reduced

The feeling of self-confidence declines

Social isolation and less social contacts

Phases of being alone and feelings of loneliness increase

#### Environmental changes:

Unfamiliar meal times

Unfamiliar table rules

Unfamiliar food

Unfamiliar environment

Ignoring these changes can lead to malnutrition and nutrition-related problems and so to reduced health, diminishing of quality of life and well-being.

Accordingly it is necessary to synchronize the individual biography of eating, the physiological, emotional, social and environmental changes to enhance the aged to feel self-determinant and self-confident.

In this presentation successful examples from residential homes for the aged will be demonstrated.

Examples will show,

that possibilities of food choice are possible to answer the need of the resident to control his environment,

how residents can be integrated in the planning and preparation of food and so correspond with the need of the residents to show their knowledge and experience,

how meals in residential facilities can be re-arranged, to let the residents experience joy and pleasure,

how nutritional concepts in residential homes can be changed so that the resident experiences himself as a subject of nutrition.

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## A8

### Sensory Design of Foods for Elderly

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Older persons need foods with well balanced energy and nutrient contents to meet their special nutritional demands. However, ageing is connected with several physiological changes that are strongly related to eating. Declining sensory capabilities, e.g. vision, taste and olfaction, affect the perception of food items as well as meals. Many older persons also suffer from chewing and swallowing difficulties (dysphagia), often combined with dry mouth problems (xerostomia). It has been stated that in the age group 70+ four out of ten persons suffer from dysphagia. Dysphagia and xerostomia not only affect older persons' ability to eat various foods. These problems also change the sensory perception by affecting the release of various stimuli from foods during the eating process.

Older persons with dysphagia require foods that need none or little chewing, yet the foods should be easy to swallow and have attractive sensory characteristics. This paper describes research in which two types of texture modified foods were studied, one meat-based and one carrot based. Samples with varied texture characteristics and sensory properties were manufactured by varying the following design parameters: degree of milling, fat content, amount and type of starch and amount and composition of egg. The sensory profiles were analysed by descriptive sensory analysis. A two step procedure was used to evaluate the samples' appropriateness to older persons with dysphagia: (1) Experts working close to elderly at hospitals and nursing homes (dietitians, nurses and speech therapists) rated all samples in focus group discussions and (2) Older persons, free living as well as at nursing homes, participated in acceptance tests on a few selected

samples. The main results are: Tastes and flavours should be intense, meals should look appetizing and the meal components should be clearly discernable and should not fall apart. Coarse milling gave more intense flavours and juiciness.

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## A9

### **Food and Drug Interaction, Consequences for the Nutrition/Health Status**

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Drug-food interactions (drug-nutrient interactions) are defined as alterations of pharmacokinetics or pharmacodynamics of a drug or nutritional element or a compromise in nutritional status as a result of the addition of a drug. Patient populations who have increased risks of suffering from adverse events associated with drug-nutrient interactions include elderly patients, transplant recipients, patients with cancer, malnutrition, gastrointestinal diseases or patients receiving enteral nutrition.

Elderly are particularly at risk because more than 30% of all the prescription drugs are taken by this population. Together with an altered ratio of body fat to muscle as a result of aging and reduced physiologic reserves, it can be expected that elderly patients are more likely to experience adverse events from drug-nutrient interactions. Multiple underlying chronic diseases, such as hypertension, hyperlipidemia, cardiovascular diseases or chronic infections require long-term nutritional and pharmacotherapeutic intervention. The practice of polypharmacy (using multiple drugs to manage different disease states) increases patients' risk of drug-nutrient interactions.

Failure to identify and properly manage drug-nutrient interactions can lead to serious consequences. For instance, some drug-nutrient interactions can result in reduced absorption of certain oral antibiotics and may lead to suboptimal antibiotic concentrations at the site of infection. This predisposes the patient to treatment failure. Several drugs should not be taken with food to allow optimal absorption. Induction or inhibition of gut enzymes by nutrients may lead to a significant change in oral bioavailability of drugs or vice versa. For example, grapefruit juice is a CYP3A4 inhibitor. The exposure of some drugs can be increased severalfold when taken with grapefruit juice. On the other hand, certain drugs may affect gastrointestinal tract function and may lead to a loss of electrolytes and fluid.

Limiting drug prescriptions to essential medications for a short period as possible and periodic re-evaluations of the treatment chosen are essential to minimize adverse drug-nutrient interactions.

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## **Food, Nutrition and Health Promotion**

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## A10

### **Diet and Physical Activity Promote Fitness and Well-Being also in the Elderly**

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The biological age, in contrast to the chronological age, can be defined by the status of eight selected biomarkers of aging:

1. daily energy expenditure; physical activity
2. maximal aerobic capacity  $VO_2$  max; endurance
3. muscle mass; strength
4. proportion of body fat
5. bone density
6. insulin sensitivity
7. relation of LDL to HDL-Ch.
8. blood pressure

Based on the assessment of these eight biomarkers, a person may be regarded as biologically "old" no matter how old he/she is chronologically. A negative assessment of biomarkers no. 2 and 3 defines weakness and being in need of assistance. Biomarkers no. 5–8 define several widespread chronic non-communicable diseases such as osteoporosis, diabetes mellitus II, and arteriosclerosis.

These biomarkers are ordered hierarchically: some of them are positively influenced by others some are not. Biomarker no. 1 consists of daily activity and training and improves all other biomarkers and thus prevents diseases and weakness. Biomarkers no. 2 and 3 improve biomarkers no. 4–8, but depend on biomarker no. 1.

Nutrition can improve biomarkers no. 4 and 6–8, but not 5, and especially not  $VO_2$  max and muscle mass and thus prevents diseases, but not weakness. Medication influences biomarkers no. 5–8, but not 1–4 and therefore prevents diseases, but not weakness.

The number needed to treat (NNT) for medications lowering blood pressure or cholesterol to prevent 1 myocardial infarction per year are 150–200. The NNT for nutrition or physical activity is 30–50. However, to improve and maintain physical fitness the only means is physical activity and training.

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## A11

### **Nutritional Interventions in Nursing Home Residents**

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There is a large evidence base for nutritional intervention in acutely ill and post operative hospitalised patients but the evidence base for nursing home (NH) residents is small. The prevalence of poor

nutrition in NHs is high and baseline nutrition appears to be an important determinant of response to nutritional intervention. Residents with mininutritional assessment (MNA) scores above 23.5 tend to show less response than those with lower scores. This relates in part to failure to increase intake in the better nourished as well as to actual response to increased intake. At the low end of the MNA spectrum, the increasing prevalence of multiple pathologies tends to result in a reduced response but randomised controlled studies in this group is probably not ethical. Most studies have tended to investigate the intermediate group with MNA scores of 17–23.5 or equivalent using other scales. Interventions have usually resulted in increased intake of calories and micronutrients. Other end points have variously shown responses including weight, immunological measures, infection rates, decubitous ulcers, falls and fracture rates. Many studies have been too small to demonstrate benefit and some are likely to have suffered from type I errors – showing benefit by chance. Poorly quantifiable variables likely to be of importance include the local environment and catering as well as pathophysiological variability.

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## A12

### **Thank Be to Body Exercise, Getting Mobile and Less Dependent**

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Referring to the total population, the number of elderly people is increasing continuously in the Western Population. For this group, the advanced years of life are often filled with chronic illness and a reduced enthusiasm to perform activities. A consequence of this is a reduced quality of life. Beside nutritional status, which is often borderline, a main cause of frailty is an increased sedentary lifestyle and the resulting lower energy expenditure. Both, inactivity and low nutrient status are important contributors to the loss of skeletal muscle mass, which is associated with a reduction in lean body mass, total body water, bone density, an increase in body fat and a decline in immune function.

Physical activity offers one of the greatest opportunities for people to extend years of active independent life and reduce functional limitations.

A combination of aerobic activity, strength training, and flexibility exercises, plus increased general daily activity can reduce medication dependence and health care costs while maintaining functional independence and improving quality of life in older adults.

One example was a study conducted recently here in Vienna, which was aimed to determine the influence of moderate aerobic endurance exercise and the intake of a multivitamin beverage (micronutrient supplement within the dietary reference intake) on institutionalized people in their 8<sup>th</sup> and 9<sup>th</sup> decade of life.

Results show improved micronutrient status due to the intervention and some indications of improved physical performance. The training did neither reduce plasma antioxidative parameter nor increased lipid oxidation.

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## A13

### **Food Frequency Index as a Measure of Diet Quality in Non-Frail Older Adults**

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The objective of the present work was to identify factors associated with diet quality in non-frail older adults measured with the Food Frequency Index (FFI).

Data from a qualitative 28-item food-frequency questionnaire was used to calculate the FFI in a sample of 444 adults aged 55 years and older living in Vienna, Austria.

In linear multiple regression models diet quality was associated with several socio-demographic factors. A higher FFI, indicating a favourable diet quality, was obtained for women as opposed to men, younger age groups and better educated subjects ( $p$  for all  $< 0.01$ ). No statistically significant associations were found between mean FFI scores and type of dwelling (living in a private home vs. in a nursing home) and living arrangement respectively (living alone vs. with a partner and/or family).

Dietary supplement users ( $p = 0.04$ ) and subjects being physically active ( $p < 0.01$ ) showed significantly higher FFI scores.

Eating difficulties ( $p = 0.04$ ) and gastrointestinal problems ( $p = 0.03$ ) were found to be risk factors for poor diet quality as measured with the FFI, whereas the number of prescribed daily medications was not associated with diet quality ( $p$  for trend = 0.77).

Differences in diet quality are evident in sub-groups of non-frail older adults living in Vienna as defined by societal factors, such as education, lifestyle-related factors, such as being physically active and health-related factors, such as oral health.

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## A14

### **The Quality of Nutrition of Elderly with Different Degrees of Dependency: Elderly Living in Private Homes**

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To be aware of the influencing factors of healthy ageing, the Institute of Nutritional Sciences of the University of Vienna has been carrying out nutrition and health surveys in the elderly living in Austria since 1991. The main objective of these studies was to identify health and lifestyle factors as well as socioeconomic influences that contribute to the nutritional situation. Some of the results have been documented in the Austrian nutrition reports 1998 and 2003.

So far, data were collected both in elderly living in private households and elderly living in nursing homes. Diet was assessed by both a qualitative food frequency questionnaire (FFQ) and a 24-h-recall. Apart from the food consumption the nutritional status was additionally examined in blood and urine samples using static and functional parameters. Information about the health situation was collected by a questionnaire.

Generally the state of health was assessed as good. The prevalence of overweight (21%, BMI > 29 kg/m<sup>2</sup>) and obesity increased with increasing age up to 65 years whereas in people older than 65 years an inverse tendency could be observed. As from this age upwards a high prevalence of underweight was found (22%, BMI < 24 kg/m<sup>2</sup>). Data from the FFQ showed that the consumption of meat and meat products was too high compared with the recommendations. By contrast the intake of high nutrient density foods was insufficient. On average the fat intake was around 38% of total energy (%E) that of saturated fatty acids amount to 20% E; the intake of carbohydrate and fibre was considered as too low. The intake of folate, vitamin D, calcium, iodine and magnesium as well as vitamin C in people older than 85 years was assessed as inadequate. More attention has to be paid to the biochemical status of certain micronutrients in order to optimise dietary intake and to sustain healthiness.

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### A15

#### **Nutritional Situation of Viennese Nursing Home Residents**

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It is well established that the older persons (more than 65 years of age) generally experience higher rates of undernutrition and are more prone to malnutrition than the general population. Whereas the prevalence of malnutrition is estimated to be 1–31% in the ‘free-living’ elderly, up to 75% of hospitalized or institutionalized elderly show evidence of malnutrition.

The objective of the present study was to assess the nutritional situation of elderly nursing home residents in Vienna (long-term-care; mean age: 86 ± 7).

MNA (Mini Nutritional Assessment) and NuRAS (Nutritional Risk Assessment Scale), tools specifically developed to evaluate the nutritional status of the elderly, have been used for the assessment of the general nutritional and health status of 248 residents. Individual intake of energy and nutrients has been measured by using the weighed food intake method during seven consecutive week days.

MNA-results showed a satisfactory nutritional status in 13.9%; 48.3% have been assessed as ‘at risk of malnutrition’ and 37.8% as being ‘malnourished’. Most frequently present nutritional risk factors amongst the residents are high drug consumption (97%), difficulty in cutting food (70.6%), depressive illness (63%), gait disorder (57%) and mental/cognitive impairment (52%). Further there is a link between the assessed nutritional status and the individual nutrient intake of the residents (e.g. correlation of energy intake and MNA Score:  $r = 0.331$ ;  $p = 0.006$ ).

The mean daily energy intake was 1,579 kcal. (6.6 MJ). Measured energy intake of 23.5% of the elderly is lower than the calculated BMR and approximately 50% of the sample cannot reach the estimated ER (energy requirement). Other critical nutrients (below the recommendations) are Vitamin D, Thiamine, Folate, Calcium and dietary fibre.

The MNA seems to be a reliable tool to identify subjects at risk for malnutrition. No systematic nutritional care is provided so far. Strategies for effective nutritional intervention should be implemented in long

term care facilities for the elderly in order to prevent and treat malnutrition and to ensure high quality care.

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### A16

#### **The Quality of Nutrition of Elderly with Different Degrees of Dependency: Residents of Care Homes – Nutritional Intervention**

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**Introduction:** People who live in nursing home have lost their independency. Nutritional problems of older people in care can be affected by standard procedures surrounding food provision and – preferences. Therefore, their eating-habits should be taken into consideration because malnutrition is frequently observed. Additionally, constipation and laxative usage are common problems in nursing homes. Current studies link both to malnutrition and weight-loss. Fiber affects also stool weight and transit time. Therefore, oat-bran effectiveness in reducing the need for bowel medication for geriatric care patients was examined.

**Aim:** To develop diets components with the addition of oat-bran for reduction of laxatives and improvement of the inhabitants’ well-being in a long-term-care facility.

**Methods:** A controlled blind parallel intervention trial among 30 frail inhabitants of a geriatric ward aged 57–100 years with laxative use. An intervention and a control group were formed. 15 of them received oat-bran for 12 weeks (fiber group) mixed up in the daily common diet of the ward and 15 served as control (control group). Laxative use, body weight and the observations concerning the eating-habits of the elderly were documented.

**Results:** A cake with the required dietary fibers and the compliant acceptance of the seniors was developed. Laxatives were successfully discontinued by 59% ( $p < 0.001$ ) in the fiber-group. Bodyweight remained constant in the fiber-group and decreased in the control-group ( $p < 0.005$ ).

**Conclusion:** Fiber supplementation in the form of a cake allows discontinuation of laxatives and increases the senior’s wellbeing.

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### A17

#### **European Nutrition and Health Report (2004): Nutritional Situation of the Elderly in the European Union**

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The European Nutrition and Health Report 2004 contains data about the nutritional situation of elderly of eleven EU-countries (Austria-Belgium-Denmark-Germany-Greece-Hungary-Italy-Norway-Portugal-Spain-UK).

The assessment of the nutritional intake of European elderly was performed using different methods (24-hour-recall, (semi-quantitative) FFQ, 4/7-day-weighted record, personal interview, HBS).

In comparison to adults of the same country the energy intake of elderly was averagely lower. Except for Spain and Norway (18%E) the mean proportion of protein intake was within the recommended range in most countries, or slightly above. The mean share of carbohydrate was considerable low – the recommended level (RL) of at least 55%E was not reached in any country (Belgium, Denmark, Greece: 41–42%E), except for Germany, the UK and Hungary, where it reached  $17 \pm 6\%$ E. The average intake of sucrose was generally below the level of 10%E. The consumption of dietary fibre varied strongly among the participating countries. The lowest intake was observed in Austria and the UK ( $>85$  y:  $14 \pm 5$  g/d), the highest in Norway, Denmark and Germany (25–31 g/d).

The mean fat intake was remarkable high (max-Greece:  $45 \pm 5\%$ E, min-Norway: 29–30%E) in European elderly. With exception of Greece, countries with a high fat intake also had a high intake of saturated fatty acids (SFA) (up to 20%E). The mean intake of polyunsaturated fatty acids (PUFAs) was too low in European elderly; this of cholesterol exceeded the upper level (300 mg/d) in nearly all countries.

The average intake of vitamin D and folate was clearly below the RLs (10 µg/d and 400 µg/d) in elderly of all countries.

Sodium intake was quite high in all participants (Hungary: 7.4 g/d in adult men), calcium intake was below the RL (800 mg/d) in several countries.

Except for a few countries, the supply of vitamin A, C, thiamine, niacin and cobalamin and the elements magnesium, iron, zinc, iodine, copper and manganese could averagely be regarded as sufficient.

Data analysis showed that the proportions of macronutrient intake of European elderly are not balanced (low: carbohydrates/dietary fibre, high: fat/SFA/cholesterol). Apart from vitamin D, calcium, folate and sodium the mean intake of micronutrients could be regarded as rather acceptable.

## A18

### Nutritional Problems of the Elderly in East and Central Europe

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In the AgeingNutrition project funded by the European Commission, partners from 10 ‘Eastern’ (new) European (Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Poland, Romania, Slovak Republic, Slovenia, and Turkey) and 5 ‘Central/Western’ (old) European countries (Austria, Belgium, Germany, Greece, and Spain) performed a comparative analysis of existing data on nutritional status, food intake, nutrient intake, dietary habits and lifestyle of the ageing population in Europe.

Using predefined inclusion criteria 36 studies (22 from Eastern and 14 from Central countries) were chosen for the evaluation. The studies varied broadly in general design, in data assessment and management and in parameters and methods used (esp. regarding assessment of nutritional situation, comprising anthropometry, blood lipid profile, dietary nutrient and food intake). Raw data for recalculation were

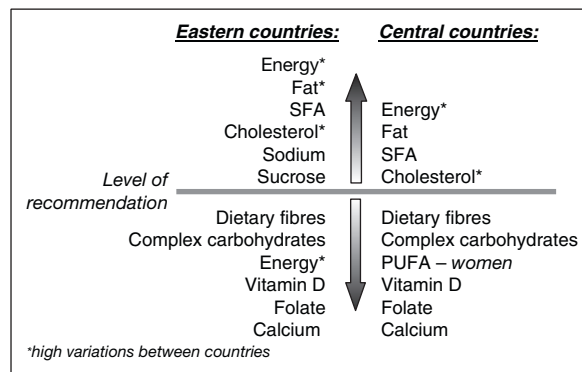


Figure 1. Overview on dietary nutrients intake of European elderly (both sexes), in relation to the respective recommended level.

not accessible in every participating country. Consequently, data comparison between ‘old’ and ‘new’ EU Member States by recalculation of raw data had to be restricted to 10 Eastern and 5 Western countries and few distinct parameters.

The figure 1 illustrates the most important findings when comparing nutrient intake with actual recommendations in both regions. Energy intake is too high in both regions, especially in some of the ‘younger old’ and seemed not to be adjusted to the energy expenditure. At the same time, in some very old seniors in the Eastern countries, energy intake was considerably lower than recommended. One essential exception is sodium intake which is clearly higher in Eastern countries probably due to a higher consumption of table salt. Interestingly, the quantity and quality of available information is not significantly different between ‘new’ and ‘old’ Member States. The immense variations in methodology, however, made it difficult to perform reliable comparative evaluation. It is, thus, mandatory to establish standard methods for assessment of nutrition and health status to be used in international multi-centre studies.

## A19

### Outcomes of the Nutri-Senex Project A Co-Ordination Action Funded by the European Commission

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This project’s primary aim is to contribute to the improvement of the quality of life of the elderly. Its benefits are likely to be felt most keenly by the frail elderly, those that require constant care by others, but its activities are not confined to this sub-group.

The state of the art in age-related research and technology, to highlight the most promising areas for development, has been documented



in an extensive literature report. A research database has been built to map current research activities within the European research area. Through several expert group meetings with representatives from universities, research organizations, organizations concerned with the care of the elderly, industry and others, suitable technologies and policies that can improve the diet of the elderly have been identified. A legislation survey relating to care for and nutrition of the elderly has been carried out to highlighting loopholes and best practice. A set of guidelines and recommendations of best practice for use in the health and care industry have been developed and to assist the implementation of these guidelines two implementation workshops in the first and second year of the project have been organized. The project's results are dis-

seminated through an enhanced website, technology transfer workshops and a staff training programme. Good communication between the partners has been promoted and permanent research links have been forged.

The main outputs will lead to better co-ordinated European research: less duplication of effort, more rapid commercialisation, increased awareness of the problems faced by the elderly, improved guidelines and recommendations for healthcare professionals and policymakers and improved quality of life for the elderly, through an improvement in the range and quality of food products aimed at this sector of society.

## P1

**Gender Specific Differences after a Supplementation with *Trans* Fatty Acids**K. Kuhnt<sup>1</sup>, S. Flotho<sup>2</sup>, S. Basu<sup>3</sup>, J. Kratzsch<sup>4</sup>, F. Spener<sup>2</sup>, G. Jahreis<sup>1</sup>

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**Background:** In recent years, gender-related differences especially in lipid metabolism were noted. After the intervention study with *trans* fatty acids gender specific results were found. The study was generally conducted to examine the conversion of *trans* 11-18:1 and *trans* 12-18:1 to the conjugated linoleic acid (CLA) isomer *c9t11*-18:2 and to the *c9t12*-18:2 by the  $\Delta$ 9-desaturase (stearoyl-CoA-desaturase; SCD).

**Design:** 24 healthy subjects (age:  $25 \pm 2$ ) started with a 14-d baseline period without supplementation. During the 42-d intervention period the test group consumed daily 6.0 g/d *t11* and *t12* [1:1] while the control group consumed a control oil. During a standardized diet (last week of both periods), blood was sampled.

**Results:** Approximately 25% of *trans* 11-18:1 was converted into CLA whereby *trans* 12-18:1 was not converted. Women showed generally a higher *c9t11*-CLA synthesis due to higher *trans* 11-18:1 conversion rates than men but without differences in gene expression of SCD. Hormones and body fat mass influence the SCD-activity. Leptin and body fat mass were significantly higher in women, while adiponectin was significantly lower than in men.

Gender-based differences regarding lipid peroxidation and gene expression were found as well. The urinary excretion of the isoprostan 8-iso-PGF<sub>2 $\alpha$</sub>  (biomarker of free radical induced oxidative stress) was significantly increased during *trans*-fatty acid supplementation. The increase was higher in female subjects.

After the intervention period the relative expression of *peroxisome proliferator-activated receptor (PPAR)* $\gamma$ , *glucose transporter (GLUT)*1, and *GLUT*4 in the male test group was significantly higher compared to the female test group. In contrast to male test group, the expression of *cyclooxygenase (COX)*2 and *B-cell leukemia (BCL)*2 was significantly higher in test females.

**Conclusion:** There are gender-specific differences in enzyme activity, hormone levels and gene expression involved in lipid metabolism. To consider differences in metabolism future intervention studies should implicitly involve subgroups of the population (gender, age).

## P2

**Epigenetic Regulation Induced by Diets and Aging**R. Thaler<sup>1</sup>, G. Karlic<sup>2</sup>, D. Schuster<sup>1</sup>, F. Varga<sup>3</sup>, A.G. Haslberger<sup>1</sup>

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Epigenetic regulation of gene expression by DNA methylation is discussed as a consequence of different environmental signals and nutrients but also related to mechanisms underlying aging.

We used real-time TaqMan PCR to analyze expression of MnSOD, bisulfite genomic sequencing PCR (BSP) for MnSOD promoter CpG methylation analysis, RTQ-TRAP assay for Telomerase activity measurement and ELISA for total DNA methylation analysis in CACO-2 cells and buccal mucosa. Groups of 40 vegetarians (20–30 yrs), consumers of the same age adhering to a conventional middle European diet (20–30 yrs) and aged consumers >85 yrs were analyzed.

In according with previous results a treatment of the endodermal CACO-2 cell line with the methyltransferase inhibitor Zebularine resulted in a  $6.6 \pm X$  ( $p < 0.05$ ) fold increase of MnSOD expression and an about 40% decreased methylation of CpG's in the SOD<sub>2</sub> promoter region. A  $2.8 \pm X$  ( $p < 0.05$ ) increased expression of the SOD<sub>2</sub> gene was observed in buccal swabs of a group of vegetarians compared to a group of the same age adhering to a middle European diet. Significantly decreased CpG methylation of the analyzed promoter region was observed consistently in the group of vegetarians. In contrast, in a group of citizens >85 yrs adhering to a middle European diet no significant changes in the expression and promoter methylation of the MnSOD gene, but a significantly reduced expression of the Telomerase in buccal swabs, in according to literature, was found.

DNA global methylation was found to be significantly decreased in buccal swabs of aged citizens compared to a group of young citizens adhering to the same diet form. No significant differences were found between the group of vegetarians and consumers adhering to a conventional middle European diet (yrs 20–30). The results suggest an effect of diets on the epigenetic regulation of the human SOD2 gene. If nutrition effects DNA global methylation in aging remains to elucidated.

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P3

### **Analysis of the Fecal Bacterial Communities in Aged Consumers and Consumers Adhering to Different Diets Using Combined DGGE and Quantitative Taqman- PCR**

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The microbiome of the human GI tract has been shown to be rather stable and resilient to external influences, but certain differences in the distribution of populations have been reported in specific situation, such as antibiotic treatment, nutrition or aging. We explore a strategy combining group specific DGGE analysis and quantitative Realtime PCR (RTQ-PCR) for the assessment of *Bacteroides* ad *Bifidobacteria* in small groups of consumers at different age adhering to different diets.

200mg of faeces from groups of 20–30 geriatric patients and young volunteers following a vegetarian or typical middle European diet have been analyzed. PCR-DGGE, cloning and sequencing, as well as RTQ-PCR using universal, *Bifidobacteria*- and *Bacteroides*- specific 16S rDNA primers and corresponding 6-FAM labeled Taqman probes were used. Specificity of primers and probes was tested using FASTA and type strains. Calculating the amount of bacterial groups as percentage of the bacterial total DNA (using universal primers), minimizes possible problems with extraction and inhibitors.

Individual differences in the qualitative diversity of the analyzed groups can be seen. Whereas dominant bands seem to be very similar additional bands in individual samples can be observed frequently. The efficiency of the RTQ-PCR assay was 0.99 and no cross reaction of group specific primers and probes could be observed. Whereas amount of total bacteria significantly decreased in geriatric patients the amount *Bifidobacteria* in this group clearly decreased where the decrease in the individuals showed high deviations.

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P4

### **Vegetarian Diet Influences mRNA Expression of Markers of Fat-Metabolism and Collagen Turnover but Not Telomerase – Relevance for Aging?**

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Previously, we demonstrated a downregulation of mitochondrial enzymes in blood, muscle and liver cells of aging subjects (which is also associated with a reduced L-carnitine uptake and lower physical activity). As the lower content of essential amino acids and a higher

intake of carbohydrates by vegetarians may also affect collagen metabolism, the aim of this study was to analyze relevant mRNAs in vegetarians (n = 15, mean age = 24 years) compared to an age-matched group of persons adhering to a conventional European diet (CED) (n = 43, mean age = 24 years) and in comparison to elderly CEDs (n = 39, mean age = 87 years).

The evaluation was done using quantitative reverse transcriptase polymerase chain reaction (RTQ-PCR) for analysis of mRNA-levels of mitochondrial enzymes (hepatic (CPT1A and non-hepatic CPT1B isoforms of carnitine-palmitoyltransferase) and collagen turnover (collagen1A, as well as collagen-degrading matrix-metalloproteinases MMPs and their inhibitors) in oral mucosa. Telomerase activity was chosen as a general marker for aging.

Compared to CEDs, vegetarians showed a significant upregulation of CPT1A and a stimulation of the carnitine transporter OCTN2, which was reduced by up to 80% in the elderly. Collagen-synthesis showed a significant reduction (10%) in vegetarians as compared to CEDs but was still significantly higher than in the elderly. This was not accompanied by a stimulation of collagen-degrading enzymes. Telomerase-activity was significantly reduced in the elderly, but there was no difference between vegetarians and CEDs.

The 2:1 CPT1A/CPTB relationship in vegetarians (compared to 1:1 in young CEDs) which was also observed in elderly is known to be associated with a shift towards carbohydrate metabolism, because CPT1A is less sensitive to malonyl-CoA. Reduced collagen-synthesis in vegetarians may be associated with dietary deficiencies. Telomerase status appeared to be independent of diet.

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P5

### **Downregulation of Collagen, Fat-Metabolism-Markers and Telomerase in Elderly: An Oral Mucosa Study**

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Diminished collagen levels, a downregulated fat metabolism and reduced telomerase activity are associated with senescence. This study was focused to analyze relevant parameters in oral mucosa of elderly (n = 39, mean age = 87 years) compared to younger adults (n = 58, mean age = 24 years). mRNA-levels of collagen turnover (type I collagen, matrix metalloproteinases (MMP1 and MMP2), their tissue inhibitors (TIMP1 and TIMP2), known markers of fat metabolism (organic cation transporter, carnitine palmitoyltransferases) and telomerase-activity were quantified by PCR (RTQ-PCR). Collagen-synthesis and expression of TIMPs were slightly reduced in the elderly, whereas expression of MMPs was stimulated, however in the same range as known for photoaging or vegetarian diet (10%) in dermal cells.

Confirming previous studies, markers of fat metabolism and telomerase-activity were reduced in the elderly at the same extent as known for blood cells (up to 80%). Thus, our study indicates that oral mucosa is suitable for studying senescence-associated molecular parameters.

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