D1

DAY 1

Official opening - Welcome

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Keynote lecture

The role of F&V in disease prevention & health promotion

E. **RIBOLI** – Imperial College London – UK

Over the past decades, very large population based prospective cohort studies have been established to investigate the association of diet, body fatness, physical activity, other lifestyle factors and related metabolic conditions with the risk of developing cardiovascular diseases, cancer, type 2 diabetes, and other chronic diseases. Most cohort studies have reported a consistent association between fruit and vegetable consumption, and reduced risk of coronary heart disease and stroke, and a statistically significant but comparatively less strong association with a reduction of cancer risk. In addition, the results of several cohort studies support a protective effect of fruit and vegetable consumption on all-cause mortality, particularly on the reduction of premature death in middle aged and older adults.

Epidemiological studies have also found that several major lifestyle factors including being physically active and maintaining a lean body mass, avoiding smoking and consuming alcohol in moderation if at all, play a major role in promoting health, preventing chronic disease and reducing premature death. Laboratory studies based on the biosamples collected at baseline in prospective cohorts have shown that these lifestyle factors influence epigenetic changes, hormonal balance, insulin metabolism, antioxidant activity and other pathways of diseases. The application in epidemiologic studies of new methods based on "-omics" is paving the way to a better understanding of the mechanisms underlying the observed associations.

These results have provided the bases for public health recommendations. Current recommendations on fruit and vegetable consumption vary from country to country from 400 g/day (equivalent to five-a-day) in the UK, to 500 to 800 grams per day in Denmark, Norway and USA. The World Health Organization and the World Cancer Research Fund both recommend at least 400 g/day. However, a recent meta-analysis has suggested that the health benefit could increase with levels of consumption even higher than those indicated in current recommendations. This meta-analysis included 142 publications from 95 cohort studies from all over the world and found a significant reduction in the risk of coronary heart disease, stroke, cardiovascular disease, total cancer and all-cause mortality with increase in intake of fruit or vegetables, and fruit and vegetables combined.

While the debate remains open on how much extra benefit can be provided by even higher levels of fruit and vegetable consumption, it is essential from a public health point of view to underlie that decades of epidemiological studies on nutrition and health have shown that low fruit and vegetable consumption is associated with higher risk of several chronic diseases and of premature death and that further health benefits and no detrimental effects have been found for diets characterised by fruit and vegetable consumptions above the currently recommended levels.

S1 HEALTH PROMOTION IN MEDICAL EDUCATION: FROM RHETORIC TO ACTION

Co-chairs: P. **JAMES** & M. **LAVILLE**

Health workforce for better nutrition

K. WICKRAMASINGHE & J. JEWELL & J. BREDA – WHO Europe – RU

This presentation aims to briefly describe the WHO/Europe workshop series for healthcare workers for nutrition promotion and to provide a summary of a recent WHO review of evidence on integrating nutrition promotion activities in primary healthcare.

Primary care plays a critical role in the provision of services to promote healthy diets, engage individuals in physical activity and assist patients in weight management. A recent review of evidence by WHO/Europe shows that these services are effective in reducing weight, increasing levels of physical activity and shifting to healthier diets. The most effective mix of interventions is strongly associated with context, so that interventions should be tailored to patients' needs and barriers. Services that simultaneously address diet and physical activity are the most effective; initial referral by a primary care physician and routine follow-up by nurses and allied health professionals result in better health outcomes. Many studies reported lack of clear guidance in clinical recommendations; outdated knowledge and competence of primary care providers, including the skills to assess and address patient resistance; unclear scope of practice; and limited work in interdisciplinary teams, misalignment of incentives and insufficient information technology support.

WHO/Europe initiated capacity building programme for nutrition promotion among health professionals working in primary health care, schools and community health centres. Participants had expertise in family medicine, nutrition and dietetics, cardiology, endocrinology and oncology, as well as pediatrics.

Based on this examples, objectives of capacity building programme could be to familiarize health professionals with the important evidence and guidance from WHO on the links between nutrition, physical activity, body composition and weight, and health outcomes. These training workshops can demonstrate, through practical exercises, existing techniques and approaches to: identify important target groups (e.g. pregnant and breastfeeding women, children) and at-risk individuals; monitor dietary intake and levels of physical activity; and monitor child growth and nutrition status in children and adults.

A crucial component of such training is providing an opportunity for participants to learn and experiment with several approaches to brief motivational interviewing through case studies and group workshops. It allows to understand the importance of patients setting realistic goals for themselves and agreeing indicators of success with patients.

Building a health workforce for better nutrition is a long term, challenging task. It requires to identify, discuss and debate potential system changes that could act as enablers, such as the development of new tools or more collaborative working methods. Prioritizing these services in the national health agenda, updating the curricula of health professionals and aligning payment mechanisms for primary care providers will require consideration in order to ensure sustainability and reforms at scale.

The primary care professional: an agent for healthy eating ?

A. **STAVDAL** – WONCA Europe – NO

Health promotion is most often about making changes in the daily routine, in which eating habits often play a major role.

There is a common understanding that a person`s eating habits reflect both societal factors and the individual context.

The family doctor meets people at all stages of life, in continuous relationships with patients over time. In the work of diagnosing and treating, the doctor is an interpreter of signs and symptoms on the basis of the patient's individual context, besides being a teacher and a witness in the course of the patient's life. In the longstanding relationship between doctor and patient, golden moments will occur. Moments when the doctor can give valuable input and be a facilitator for needed change in lifestyle behavior. To achieve that, trust is needed. Trust builds on respect of, and understanding of, the patient's resources and life challenges. When the patient has experienced that the doctor holds this respect and is responsive to his or her needs, change can be a part of the conversation.

There is a lot of information about healthy lifestyle available and the public is often well informed about the basic principles. The hard part is to transform knowledge into action. The person centered approach, the working method in family medicine, is the key to help this transformation come true.

The primary care setting offers an incentive for both parties to reach a mutual understanding of what is at stake, identifying when a crossroad is reached, and agreeing that change is advisable. The patient must feel convinced that reward by a change away from unhealthy habits, will outweigh the prize to be paid and sacrifices made. The doctor must understand what situation the patient finds himself in, and making a judgement whether the moment for introducing a plan for lifestyle change is the right one. The physician must advice the patient not to set the bar too high, be ready for support when setbacks and disappointment occur, helping and nudging the patient to uphold motivation and to stay on track over time.

This talk will focus on how the family doctor can give inspiration and support in the transformation process linked to nutrition and healthy eating.

Health promotion in primary healthcare: how well are French clinicians prepared?

M. LAVILLE – Claude Bernard Lyon 1 University – FR

Medical studies in France are mostly devoted to disease and very few to health promotion. Nutrition, for example, is taught only few hours during the medical courses and is not always taken very seriously by the future physician. However, the need for health promotion is obvious: 80% of adults have sedentary habits, 25% of young over 17y are smokers and 12% take alcohol several times a week. Thus, there was awareness at the government level with prevention of diseases and inequity as main goal.

It has been decided, this year, to add to the medical studies a specific course called "health service" that should be mandatory for all the students working in the medical field (MDs, pharmacists, dentists, nurses...). During these courses they will be trained on promotion of health according to the type of population. They will also have a real life exercise by group going to school, nursing home... to discuss about a health problem. For this first year, nutrition and lifestyle has been chosen as main theme. 50000 students should be trained this year.

S2 PERSISTENCY OF UNHEALTHY HABITS. NEED AND RIGHT FOR A HEALTHY DIET WORLDWIDE

Co-chairs: E. **RIBOLI** & M. **LAVILLE**

Why it took so long to define a healthy diet?

P. JAMES – London School of Hygiene & Tropical Medicine – UK

Nutritional thinking was dominated for most of the last century by concepts of vitamin and mineral deficiency but the issue of trying to put this into practical terms for everyday use was left to dietitians and nutritionists. Advising people to eat fruit and vegetables (F&Vs) was based on minimising vitamin C deficiency (scurvy) so very little F&V was required. Then in the early 1980s new policies for preventing coronary heart disease (CHD) by reducing saturated and total fat were introduced with much discussion about the value of F&Vs in CHD prevention because of F&Vs' anti-oxidant properties. Then in 1990 a new approach was taken to develop practical dietary goals for the prevention of major adult chronic diseases. Colon cancer was thought to be partially prevented by more fibre from more whole grain cereal and F&Vs. It was proposed that the average person should eat at least 400g daily of F&Vs to not only prevent constipation but also CHD and colon cancer. This 400 g/d in USA terms was 5 portions since a portion equalled 80g. The amount chosen was based on a) specific Scandinavian and international analyses of diet and colon cancer b) metabolic studies of how much F&V and whole grain cereals were needed for an effective laxative effect c) estimated national Mediterranean F&V intakes, d) continuing evidence that F&Vs could well help prevent CHD and, e) F&Vs' potassium content, helps reduce high blood pressure.

The recent special focus on the effect of sugar in increasing obesity and dental caries means that we should severely limit all sugar intake but this does not include the sugar in F&Vs. Continuing analyses of a wide range of cancers continue

to suggest that F&Vs are beneficial so the challenge is how best to induce substantial increases in F&Vs intake in both children and adults of all ages. Policies geared to population change not only involve changing government agricultural/food policies but also substantial changes in the pricing and availability in all catering facilities funded in any way by government. General practitioners have a role both in terms of individual patient advice and in the way they advise and promote local societal changes.

Recommendations for general practitioners:

1. Ensure you understand what 400g daily of F&Vs means in practice recognising that this is an average figure and adult men should probably be on >600+grams/day; children over 5 years can handle 400 g/d.
2. When asking about a patient's intake it is best to enquire about a household's weekly shop rather than ask about yesterday's intake. Develop 5 practical steps with variety of vegetable and fruit options.
3. Combine some GPs' long standing practice of a health centre displaying a weekly notice about the cheapest F&V options in particular shops/supermarkets and promote changes in providing "free" vegetables and salad bar in local businesses and local government catering by hiding the price in the main meal cost as in the remarkable successful Finland approach.

Food security, food safety & healthy nutrition: are they compatible?

H. WALLS – London School of Hygiene & Tropical Medicine - UK

Food safety, healthy nutrition and food security are each key aspects of food systems with implications for population health. Food safety addresses foodborne illness, and covers the handling, preparation and storage of food. Healthy nutrition is about the nutritional quality of diets, with implications for malnutrition in all its forms, both underweight and associated micronutrient deficiencies, as well as overweight, obesity and associated non-communicable diseases. Food security covers food safety and healthy nutrition, but also relates to what have been described by the Food and Agriculture Organization as the four 'pillars' of food security: availability, access, utilization and stability. This presentation addresses how food security, food safety and healthy nutrition are in one sense absolutely compatible, and in another sense, absolutely not compatible.

Food systems have been conceptualized in various ways, with food safety, healthy nutrition and food security each component of most conceptualizations. The three issues are clearly components of recent conceptualizations of food systems – e.g. a framework of the High Level Panel of Experts on Food Security and Nutrition (2017), the other from the Agriculture, Nutrition and Health Food Environments Working Group (2018). Conceptually, as necessary components of a healthy food system, they are compatible. Thus, the answer to the question posed in the title of this presentation would be 'yes, absolutely'.

However, whilst conceptually compatible, addressing these issues is fundamentally a political issue, and their different characteristics mean that they are considered differently by policymakers. Thus, from the perspective of food system politics, the answer to the question posed in the title of the presentation would be 'absolutely not'.

Addressing these issues on the political agenda requires their political prioritization – which is the extent to which political leaders pay attention to addressing the issue, and back that with resources (financial, technical and human resources). However, rather than being a rational and evidence-based process whereby policymakers prioritise issues based on their importance and act accordingly, policymaking is instead often complex and non-linear, with issues addressed based on stakeholder values and the resonance of them as ideas. Policymakers respond very differently to immediate issues – such as food safety, with its acute implications for food-related health and wellbeing – than longer-term or more chronic issues, such as healthy nutrition. Characteristics of food security such as the emphasis on availability, access and system stability are again different to those of the other two issues – characteristics with different resonance to different stakeholders.

Thus, in terms of their conceptualization, the three issues are absolutely compatible, and in terms of their politics, they are absolutely not. The challenge here for food systems researchers and advocates is to find ways to improve the compatibility of food safety, healthy nutrition and food security from a political perspective, and increase the tractability on the political agenda of all three of these important aspects of a healthy food system.

Recommendations for application in daily practice:

1. Raise awareness in the community of the importance of all three of food security, food safety and healthy nutrition for healthy food systems and population nutrition and wellbeing.
2. Be cognizant that policymaking is not a rationale process with decisions often not based on evidence of burden of disease or other impact.
3. Contribute to increasing the political prioritization of more neglected aspects of healthy food systems through, for example: leadership and advocacy that understands political contexts, improved (resonant) issue framing and portrayal, and developing credible measures of the problem (and communicating it in compelling ways).

Parallel session

S3 "THE EARLIER THE BETTER": FROM PREGNANCY TO BREASTFEEDING, TO...

Co-chairs: M. **CAROLI** & D. **WEGHUBER**

Parallel session

S4 "IT IS NEVER TOO LATE": FOOD AND HEALTH IN ADULTHOOD

Co-chairs: M. **LAVILLE** & A. **STAVDAL**

Epigenetics and Pregnancy

U. SIMEONI – Lausanne University – CH

Next to our genetic make-up, our environment and lifestyle exert a great influence on our health status. This is especially intuitive for chronic, noncommunicable diseases, such as diabetes and cardiovascular disorders, which are major causes for early mortality. In recent years, more and more data are being published suggesting that chronic diseases at adulthood have early origins during development. Especially, early interactions between the environment and the genome have been shown to shape lifelong trajectories which translate into a healthy life course or an increased risk for chronic disease in the offspring. During the key window of sensitivity constituted by the peri-conceptional period, pregnancy and infancy – the so-called first 1000 days of life -, environmental stimuli such as nutrition, exposure to toxicants or stress, determine lifelong lasting, trans-generationally heritable effects, possibly due to epigenetic imprinting. This concept has been described as developmental or fetal programming, within the general frame of the developmental origins of health and disease (DOHaD). Accordingly, during the sensitive and vulnerable period of early development, stimuli related particularly to stress, nutrition and toxicants do not only have short term effects, but may also influence lifelong and trans-generational health.

Increasing evidence shows that early epigenetic imprinting, which memorizes early interactions between genes and the environment, and translates them into durable changes in gene expression, without affecting the gene sequence, is strongly influenced by the early environment. This is not as surprising as epigenetics are key mechanisms in normal cell differentiation, therefore in organ and function development, by silencing part of the genome which is not involved in the differentiated cell functions, and enhancing the expression of the genes specifically involved in such functions. Arrested development and altered developmental programming, in association with the leveraging effect of the cycle of reproduction are considered as possible factors and may rely on epigenetic changes of genes regulation as a molecular support. Converging findings show that epigenetic imprinting is associated with the level of expression and activity of specific genes involved during development and in the long term setting of the regulation of biologic systems functions, such as those involved in metabolic and cardio-vascular physiology.

Epigenetics molecular mechanisms involved in the early determinants of health and the risk of chronic disease over the life course are based on three principal mechanisms, that involve DNA modifications (e.g. methylation and hydroxymethylation), histones' post-translational modifications (e.g. acetylation, methylation, and ubiquitination) and non-coding RNAs (e.g. micro-RNAs, lnc-RNAs, pi-RNAs). These mechanisms orchestrate genes expression throughout development and at a lower level over the life course without changes in DNA sequence, under the effect of the environment.

The implications for individual and public health promotion are that:

1. Early prevention during the window of opportunity opened by the pre-conception period, pregnancy and early infancy, i.e. oriented toward future parents, pregnant women and infants, is the most efficient and cost-effective public and global health approach to reducing the burden of chronic, noncommunicable diseases;
2. Early prevention should be focused on lifestyle measures, including a healthy nutrition, exercise, exposure to stress and to environmental toxicants such as endocrine disrupting compounds;
3. Personalized or precision approaches should be based on the epigenetic diversity induced by early environmental exposure (epigenome-wide association studies) in addition to genome-wide associations;

Dietary diversification: a natural need

ML. FRELUT – ECOG – FR

Weaning and dietary diversification are key periods in early life. Between 4 and 6 months of age foods will be *added* to milk, but not substituted to it. Energy content, nutrients intakes, tastes will change. Understanding the issues behind these changes is of paramount importance in order to reach nutritional balance and allow adequate growth and development on a short and long term basis.

Milk as a unique food provides both water and nutrients. As a consequence, babies feeling thirsty have to eat while those who are hungry will also be provided water. In breastfed babies (BF), the composition and taste of milk changes over time and are adapted to the most likely requirements: its shifts from a watery consistence when starting to suckle to a fat bulk at the end of the feeding. Hydration is provided before energy needs are fully covered. In non BF babies the composition of the milk, provided as an adapted formula, is constant preventing the baby from such adaptation and fine tune.

Vegetables and fruit are introduced between 4 and 6 months of age in non premature babies. The impact of the complementary food may have opposite effects. Two extreme situations can be observed during the first weeks of diversification: an increase in energy intakes (EI) from new foods while the amount of formula or equivalent as dairies remains stable. In contrary, transitory decrease in EI can take place when vegetables given as starter at lunch time induce satiety and milk or dairies intakes slightly decrease. Providing fruits at the end of the meal or as a starter in the afternoon meal is another way to satisfy the child needs without increasing milk or dairies intakes beyond requirements.

The peak of fatness, as evidenced by BMI curves, is reached between 6 and 12 months of age. Babies also start moving significantly and enhance energy expenditure allowing spontaneous regulation of body composition. In fat babies, vegetable and fruit consumption will provide high bulk low calorie foods and allow limiting milk intakes at their upper level, i.e. 240 ml X 4/day.

Postponing the introduction of sources of starch proves helpful in this case. In lean babies which have not reached the upper limit of milk intakes and have a moderate appetite, new foods may enhance the pleasure to eat and increase energy intakes. In this case, the introduction of vegetables, fruits and carbohydrates from starch and the addition of fat allow enhancing nutritional density of the meal.

Dietary diversification is a necessary and natural process which can be adjusted in order to maintain an adequate growth pattern.

Complementary feeding: which model?

M. CAROLI – ASL Brindisi – IT

Between 6 and 24 months all the infants start to consume solid foods. This period, previously called "weaning", is now defined as "complementary feeding". This is an important variation as complementary feeding takes into account the main source of energy in the first year of age: human milk or formula.

Until few years ago paediatricians didn't use to differentiate foods recommendation between infants breast-fed or formula-fed, but this behavior didn't consider the deep and strong difference in human milk and formula formulation. Until milk is the main source of energy, which usually ends at the end of the first year of life, the two groups of infants must be fed in a different way, according the nutritional content of human milk and formula.

Recently, it has been recognized that the nutrition of the first 1000 days of life can have effects until adulthood and, thus, we must be very careful when we recommend complementary feeding.

Weaning is heavily influenced by the habits and culture of the place, but new scientific information must be the basis of choices for the respect of the right to health of children.

Nutrition consists of two branches: one is given by the nutritional and metabolic aspects and the other by the relational aspects. The development of taste is also fundamental to build healthy eating habits since the very early age. Finally, to get a healthy and proper diet for infants we have to know what, when and how much food is right to offer to them.

When. For many years, children have been weaned too early, in contrast with the WHO recommendation which advises to start solid foods at 6 months of age that means 180 days of life.

What and how much. Again, for many years the paediatricians' prescriptions have been very restrictive, giving too many useless rules regarding the order of foods' introduction and portions' size.

In contrast with the previous excess of rules, nowadays a new model of weaning is taking place, the so called "Baby-led-weaning (BLW)". The BLW affirms that infants since 6 months can eat whatever they decide to eat, from their parents table, as far as they assume by their little fingers, without any limitation in terms of food's kind and serving, as they instinctively know what and how much eating. This is true when we consider the amount of foods, but infants cannot differentiate among protein, fat and sugar foods' content and, thus, they cannot protect themselves from a too high protein or salt or sugar intake. Moreover, many studies have shown that this model cannot satisfy infants' need of iron, calcium, whereas there is an excess of proteins, salt, and often sugar intakes.

This model, furthermore, doesn't take into account the long term effects of the early diet. The other principle on which BLW is based is that this model favours a healthier development of eating habits and that protect from obesity development, but studies on this topic have been conducted with questionable methodology and show conflicting results.

In summary, if we want consider the antique wisdom which says that: "virtue lies in the middle" we could recommend to families who have an infant who has to begin assuming solid foods:

1. Start solid foods at 6 full months: 180 days, according the WHO recommendations;
2. Start with different solid foods considering whether the baby is breastfed or formula;
3. Remember what the baby eats has the same importance as how the baby is fed;
4. Note that the future health of the infant is programmed between 6 and 24 months.

Early chemosensory experiences and subsequent food choices

L. **MARLIER** – CNRS – FR

Some food preferences are shaped very early during ontogenesis. The perinatal period could even be a key period in building the foundations of our food history. This presentation contains data on the emergence of chemosensory systems, on the traces left by initial gustatory and olfactory experiences, and on the mechanisms that may lead to the channelling of taste in children.

The anatomical data first show that the chemico-sensory systems involved in the perception of foods develop during prenatal life and that gustatory and olfactory receptors in particular are mature at the end of the first trimester of gestation. Moreover, an examination of the chemical composition of amniotic fluid reveals that this fluid contains numerous chemical molecules capable of activating the olfactory and gustatory receptors of the foetus. Some of these molecules, such as sugarcane scented glycolic acid or milky scented lactic acid, are part of its basic composition. Other smells and flavours are transferred to the amniotic fluid according to maternal food choices.

Therefore, many food flavours "colour" the amniotic fluid, and more generally, each meal taken by the mother results in a palette of aromas transferred to the amniotic fluid and to the child.

One of the experimental strategies used to examine the possibility of sensory impressions left by foetal life has been to examine a newly born child's responses to odours extracted from the amniotic environment. Therefore, children exposed in utero to the aroma of aniseed, carrot or garlic demonstrate positive facial responses (smiles, relaxation of the facial muscles) and appetitive oral responses (sucking movements, licking, attempt to seize) towards these same flavours after birth. Such familiarisation processes will continue during breastfeeding, since milk also carries the aromas contained in the maternal diet. Studies show that this early appetence for certain flavours could persist during childhood, even up until adult life.

These perceptual signposts could be acquired through several mechanisms. Firstly, amniotic chemistry could differentially channel the development of certain categories of neuroreceptors, select synaptic connections that are more often activated than others, or skew the expression of certain receptor proteins. Data obtained on animal models show for example that the dominant odour note of amniotic fluid (obtained by aromatising a pregnant female's food) causes the newborn to both a preference and en increased sensitivity towards this aroma compared to a new aroma.

In addition to these peripheral mechanisms, a variety of associative or non-associative cognitive mechanisms could intervene as early as prenatal life. The foetus and the newborn can indeed attribute a positive and appetitive value to an aroma simply by having been exposed to it (mere exposure). But an aroma can also be made aversive by negative conditioning (by intraperitoneal injection of a substance triggering discomfort or by performing an temporary anoxia) as has been demonstrated in animals. This defensive mechanism is reflected later in selective food avoidances. Such mechanisms are not excluded in our own species.

These sensory traces formed during foetal and neonatal life will channel the child's tastes, and are therefore important to allow the child to select their food efficiently, and to open up to a certain dietary diversity, especially in terms of fruits and vegetables, thus promoting their long-term health.

Parallel session

S3 "THE EARLIER THE BETTER": FROM PREGNANCY TO BREASTFEEDING, TO...

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S4 "IT IS NEVER TOO LATE": FOOD AND HEALTH IN ADULTHOOD

Co-chairs: M. **LAVILLE** & A. **STAVDAL**

Prevention of premature mortality related to chronic diseases and fruit and vegetable intake

T. NORAT – Imperial College London – UK

Fruits and vegetables are part of "healthy" dietary patterns and dietary recommendations or guidelines emphasize the importance of consuming fruits and vegetables. Depending on the country, the recommended amounts vary from 400 grams to 800 grams per day. Cancer and cardiovascular diseases are the main causes of death worldwide. There is evidence that fruits and vegetables can reduce cardiovascular disease risk. However, the evidence that fruits and vegetables can have a role in the prevention of cancers has weakened in the last decades. The most recent and complete evaluation of the scientific data was published by the World Cancer Research Fund (WCRF) in 2018. The WCRF experts concluded that there is strong evidence of a preventive effect of fruits and vegetables against cancers of the mouth, pharynx and larynx but the evidence is weaker for most frequent cancers. For other cancers, the data suggests a protective effect of fruit and vegetable intake on breast cancer (oestrogen-receptor negative) and oesophageal cancers, and of citrus fruits in gastric cancer (cardia). The studies suggest that the risk of lung cancer tend to be lower in smokers with higher fruit and vegetable intake compared to smokers with lower intake, and that low intake of fruits and vegetables may increase the risk of colorectal cancer. Therefore, it is important to examine what could be the influence of fruits and vegetables intake on all-cause mortality in large population studies. A systematic literature review of 95 prospective studies published up to 2016 showed that people with the higher consumption of fruits and vegetables in the studies experienced 18% lower risk of dying than those with the lowest intakes. Similar results were observed for fruits and vegetables when analysed separately. Most of the observed benefit could be attributed to a decrease risk of death for stroke and coronary heart disease during follow-up, although whereas for cancers a 7% lower mortality was observed among higher compared to lower fruit and vegetable consumers. The review also showed a decrease of all-cause mortality with increasing levels of fruit and vegetable intake up to the highest observed intake of 800 grams per day, suggesting that intakes higher than the recommended values of 5 portions a day (approximately 400-500 grams) could contribute to reduce premature deaths.

Fruit and vegetable consumption and cardiovascular disease prevention

M. VERSCHUREN – RIVM – NL

What is the evidence regarding the role of fruits and vegetables in cardiovascular disease prevention? The evidence for dietary recommendations is based mainly on prospective cohort studies. More and more the focus in dietary research is shifting from single nutrients to foods and food groups and to the totality of our diets (dietary patterns). Also with respect to making recommendations to the public, it is easier to formulate an advice based on foods than it is to give advice on the amount of nutrients. People buy and eat foods, and they do not go to the supermarket to buy nutrients. The European Guidelines for Cardiovascular Disease Prevention recommend to eat 200 grams of fruit and 200 grams of vegetable per day.

Prospective cohort studies have shown a protective effect of consumption of fruits and vegetables on cardiovascular diseases. A recent meta-analysis showed that with each 200 g/day increase in fruit and vegetable intake, the risk for coronary heart disease was lowered by 8% (RR 0.92; 95% CI 0.90-0.94), the risk for stroke by 16% (RR 0.84; 95% CI 0.76-0.92) and the risk for cardiovascular disease by 8% (RR 0.0.92; 95% CI 0.90-0.95). When looking at fruits and vegetables separately, risk reductions were more or less similar. The protective effect of fruits and vegetables was observed up to intakes of 800 grams per day, which indicates that eating more than the current recommendations yields additional health benefits. With respect to fruit, dietary guidelines across the world differ with respect to the recommendation on pure fruit juice. The 2016 UK dietary guidelines state that one portion of the recommended 'five a day' can be replaced by pure fruit juice. Replacing fruit by pure fruit juice might be a practical solution for people to meet the recommendation for fruit consumption when for any reason more fruit consumption is difficult. In contrast, in the Dutch dietary guidelines of 2015 pure fruit juice is classified in the same category as 'sugar-containing-beverages' because of its comparable sugar-content. Therefore, the advice is to keep consumption of pure fruit juice to a minimum. Pure fruit juice contains less dietary fiber and vitamin C than whole fruits. However, pure fruit juice still contains a high concentration of polyphenols, which might reduce the risk of CVD (13-16). A number of mechanisms are known by which fruit and vegetables reduce the risk of cardiovascular diseases. These include anti-oxidative and anti-inflammatory effects, as well as effects on blood pressure. Fruit and vegetables are a rich source of potassium, vitamins and bioactive compounds. Research is ongoing to unravel pathways by which (different components of) fruits and vegetables influence disease risk.

For dietary advice to prevent cardiovascular disease in every day practice the recommendations are:

1. Eat at least 200 gram fruits per day and 200 gram vegetables;
2. A higher consumption will further reduce cardiovascular risk;
3. Eat a wide variety of fruits and vegetables;
4. Do not replace fruit by fruit juice .

Modulating the gut microbiota by fiber-rich vegetables: a promising therapeutic approach in obesity?

N. DELZENNE – Louvain Drug Research Institute – BE

The gut microbiota composition and functions can be altered in several pathological conditions including obesity and related metabolic alterations, malnutrition, or psychological disorders. In mice models of obesity, we have shown that dietary fibers with prebiotic properties (fructans, arabinoxylans...) lessen adiposity, steatosis, vascular dysfunction and inflammation, namely by modulating the gut endocrine function (differentiation of L cells, production of glucagon-like peptides). Most of the data relating the effect of prebiotics on obesity in humans have been obtained upon dietary supplementation with isolated inulin, either synthetized from sucrose, or extracted and purified from non-edible sources, such as chicory roots. In the context of a multidisciplinary project (Food4Gut project https://sites.uclouvain.be/FOOD4GUT/), we have shown that some vegetables locally cultivated in Wallonia (Belgium), contain substantial amount of inulin-type fructans. We have tested the impact of a food-based intervention with those vegetables in healthy volunteers on gastro-intestinal tolerance, behavior, and appetite sensation. The data presented will show how the changes in the dietary habit with such vegetables for two weeks can modulate the gut microbiota composition and activity. This nutritional approach has also been tested in a cohort of obese patients. The data obtained by us and others suggest that the individual response towards nutrition intervention in obesity is namely dependent on the gut microbiota composition. As practical issues, we can propose that 1) some vegetables are particularly rich in dietary fibers with prebiotic properties 2) such food products might be interesting in the management of microbial dysbiosis associated with metabolic disorders and to promote dietary fibers intake and 3) some progresses can be made in the elaboration of adequate intervention studies and in the development of new biomarkers related to microbiota-nutrition interactions. The last objective fits with the ones of the JPI FiberTAG project that will be presented during the meeting (https://www.fibertag.eu/).

F&V consumption and mental health

S. STRANGES & K. ANDERSON – Western University – CA

Positive mental health or mental wellbeing has recently emerged as an important predictor of overall health and longevity. Mental wellbeing is more than the absence of mental illness or psychiatric pathology. It implies 'feeling good' and 'functioning well' and includes aspects such as optimism, happiness, self-esteem, resilience, agency autonomy and good relationships with others. Arguments have been advanced that mental wellbeing and mental illness may represent two different but correlated continua. The case for the promotion of mental wellbeing has been advocated on both health and economic grounds, because mental illness is hugely costly to the individual and to society, and lack of mental wellbeing underpins many physical diseases, unhealthy lifestyles and social inequalities in health. As a consequence, mental wellbeing now assumes an important place in mental health and public health policy.

A large body of epidemiological and trial evidence supports the beneficial role of fruit and vegetable intake in general wellbeing and prevention of major chronic diseases across several populations and age groups, including positive effects in the prevention and management of common mental disorders, such as depression and anxiety.

Epidemiological evidence on the behavioural correlates/determinants of positive mental health, as opposed to mental illness, is now emerging. Recent findings from population-based studies suggest that higher intake of fruit and vegetable may be associated with increased odds of high mental wellbeing and reduced odds of low mental wellbeing. Specifically, in cross-sectional analyses from the Health Survey for England on a large nationally representative sample, fruit and vegetable consumption was the health-related behaviour most consistently associated with low and high mental wellbeing; these novel findings suggest that fruit and vegetable intake may play a potential role as a driver not just of physical but also of mental wellbeing in the general population. In addition, several antioxidants found in fruit and vegetables have been shown to be associated with optimism and positive mental wellbeing in middle aged adults. Studies have also reported a dose-response relationship of fruit and vegetable intake with mental health, up to seven portions a day. Fruit and vegetable consumption might also be acting as a proxy for a complex set of highly correlated dietary exposures, including fish and whole grains, which might contribute to the observed associations with mental wellbeing. As most of the epidemiological data is based on cross-sectional studies and given the lack of definitive evidence on potential mechanisms linking fruit and vegetable intake with mental wellbeing, further prospective studies and randomized clinical trials should be carried out to corroborate the causality of the epidemiological data.

In terms of recommendations for the application in daily practice:

1. People should strive to meet recommended dietary guidelines (at least 5 portions, 400g/day); fill their plate with fruits and veggies during every snack or meal;
2. Add more color and variety to diet by trying new types of produce, which will enhance nutritional diversity;
3. Improve home environment by placing fruits and veggies in prominent places;
4. Integrate fruit and vegetables intake within an overall healthy lifestyle.

S5 FOR A HEALTHY DIET WORLDWIDE: ROLE OF GENERAL PRACTITIONNERS (GPS) IN THE WIN-WIN SOLUTION

Co-chairs: A. **MARTIN** & D. **DURRER-SCHUTZ**

F&V consumption & chronic disease prevention: What are the possible "wins-wins"?

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Obesity and its related non-communicable diseases (NCDs) such as cardio-vascular diseases, diabetes, and certain cancers, have a high cost for societies. Treatment cost for obesity-related diseases represents about 10% of total health expenditure in OECD countries, and productivity losses due to obesity-related diseases (e.g. worked hours, absenteeism, early retirement) approximate below than 1% of GDP (Gross Domestic Product).

Unhealthy food consumption, including inadequate consumption of fruit and vegetables (F&V), is a major risk factor for obesity and related NCDs. However, only 12% of European adults report having five portions of F&V daily as recommended by WHO guidelines.

OECD analyses show that low F&V consumption, poor diet and insufficient physical activity tend to cluster in specific population groups, especially among individuals with lower socioeconomic status or lower education level. People-centred public health actions as those targeting individuals at high risk of NCDs, children and younger adult, have the potential to be efficient interventions to promote a healthy lifestyle and decrease the likelihood of obesity.

To tackle NCDs and reduce poor nutrition, countries have adopted a range of policy options, including regulatory policies, communication policies, school-based and worksite interventions, interventions in the primary care setting, reformulation of products, and changes in portion sizes. In particular, a number of policies in place have shown to be effective and cost-effective to reduce the burden of NCDs.

- The most effective policy intervention – but also with the highest implementation cost - is the counselling by a primary care physician and a dietician to people at high risk. OECD analysis shows that the implementation of this intervention in Europe would produce a gain of one year of life in good health in one person every ten. The intervention would become cost-effective in about 10 years after its implementation.
- Mass media campaigns to increase F&V consumption through broadcasts on television and radio channels at national and local levels are common in OECD countries (such as the "5 a day" campaign in Chile, Estonia, Germany, Mexico, New Zealand, Spain, among the others). Mass media campaigns can increase F&V consumption by 18 grams per day, and show positive return on investment a few years after their implementation.
- Food labelling -in store or at restaurant- nudge people towards healthier food choices. For instance, easy-to-understand interpretative labels put in front of packaged food can significantly improve people's food choices and diet.

Such labels are in place (on a voluntary basis) in Australia and New Zealand (Health Star Rating), Denmark, Norway and Sweden (KeyHole), England (Traffic Light system), and France (Nutri-Score). Likewise, food labelling is effective and cost-effective in tackling NCDs.

- School-based interventions to promote F&V consumption through F&V provision and nutritional education to children, such as the EU School Fruit and Vegetables Scheme, effectively promotes healthier diets and, by having a higher impact on children from families with a low socioeconomic status, contribute to reducing social inequalities among children.

Insufficient consumption of F&V is only one aspect of the obesity and NCDs problem, with high consumption of fat, salt, and sugar, lack of physical activity, and high rates of sedentarity as the other main drivers. The problem needs to be addressed globally because of its multiple dimensions. Key sectors of the economy –beyond the health sector-, such as agriculture, environment, finance, transport, and sport, as well as all stakeholders, have a role to play in obesity and NCDs prevention.

Promoting a healthy diet through counselling in primary care

D. DURRER-SCHUTZ – EUROPREV – CH

A plethora of information (sometimes contradictory) is available, coming from different heterogeneous sources, on the type of diets recommended to remain in good health. This is somehow confusing for the patient. The EUROPREV group (network of EUROpean of GPs involved in global PREVention) has performed a study in 200 centers from 22 European countries to evaluate several issue: 1/ The patients' own judgment about their eating pattern and their physical activity; 2/ The attitude of their GP's regarding nutritional prevention; 3/ What do the patients need to learn about healthy nutrition and how and where to get the information.

The results of the survey were disparate. Considering the global analysis and taking the extreme results, it was found that in France for example, most patients considered to eat a healthy diet, whereas in Lithuania, it was the reverse. Patients confirmed that they want to receive pertinent information directly from their GP's, through leaflets or individual counseling. Recently, we have produced a practical, well-illustrated leporello on obesity issue (which includes nutrition & physical activity), tailored for GPs and entitled: *"Practical visual guide for Obesity Management in Primary Care"*, freely available. Practical recommendations are important for GPs' and patients. According to EUROPREV's view, these can be summarized into 5 points:

1. To promote the Mediterranean diet in primary prevention: a classical meta-analysis has shown a significant reduction averaging 9% in total and cardiovascular mortality , a reduction in cancer mortality of 6% and a large decrease in the incidence of Parkinson and Alzheimer diseases of 13%;

2. To decrease the total sugar intake (saccharose, glucose and fructose) in particular in liquid form (sodas) ; sugar drinks are considered as "empty calories", are at risks for weight (fat) gain and hepatic net *de novo* lipogenesis. Ultimately this leads to metabolic disorders, in particular when sugars are consumed chronically, in excess of total carbohydrate oxidation;

3. To decrease the consumption of industrialized products: most of these products contain hidden (saturated) fat and sugar and excess added salt. They also can be a source of hydrogenated or trans-fatty acids and are often "polluted" by exogenous food additives;

4. To eat in full consciousness, following the physiological sensation of hunger and satiety i.e. to eat slowly by chewing (masticating) a long time in order to be aware of the different flavors released from the food as well as to ingest food with pleasure and without stress;

5. To stimulate daily life physical activity (not necessarily by being involved in structured and intense sporting activities). As a matter of fact the key message is that we should not dissociate the nutritional aspect from the physical activity one. The reason is that the physiological control of food intake to maintain body weight is much more efficient when the individuals are physically active rather than sedentary;

Finally, let's recall that a WHO Experts Committee (2010) has recommended that both nutrition and physical activity could be "prescribed" by GPs in primary care medicine, reinforcing their important role which goes much beyond the prescription of drugs.

Importance of F&V in the prescriptions of general practitioners – Feedback from the pre-Egea symposium.

A. MARTIN – Claude Bernard Lyon 1 University – FR

In opinion surveys, general practitioners receive a high degree of trust in food and nutrition counselling. But, what is the place of these topics (and especially concerning the role of F&V on health) in their daily medical consultation? What is the influence of their own dietary habits on this counselling? How future practitioners integrate these recommendations into their daily life during their medical studies? What are the expectations of their patients in this area, especially when they want to follow some special regimen? It is this type of questions which have been addressed during the pre-Egea symposium through the presentation of qualitative or quantitative researches carried out by medical residents of the Lyon 1 Medical School during their internship in GP offices, in the context of their initiation to research and the preparation of their thesis of medicine. A better knowledge of the practical realities and of the barriers to the diffusion and use of recommendations of the Nutrition Health Policy Program (PNNS) will help in the future to design adapted tools and communication for assisting GP in nutrition counselling.