S.III.1.

Primary cancer prevention – is it possible? How much can we prevent?

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Cancer is an increasing health and economic problem worldwide. The WHO estimates that worldwide cancer mortality will rise from about 8.2 million deaths in 2012 to 8.7 million in 2015 and 12.6 million 2030. This 45% increase is largely due to increasing numbers of people living to older ages, when cancers are more common. In Europe 3.6 million people are diagnosed with cancer every year and within 20 years from now the number is estimated to increase to 4.3 million. Number of patients with chronic cancer disease who are dependent on health care system is increasing even faster. In Sweden every third person is at risk of developing cancer, however, among them who are born after year 2000 it is estimated that every second may develop cancer.

On the basis of present knowledge of risk factors, between a third and a half of cancers may be preventable and primary prevention is a particularly effective way to fight cancer. Primary prevention of cancer *via* a healthy diet and healthy lifestyle – including physical activity, normal body weight, no smoking and limited alcohol drinking – has also several other advantages. It is also effective in prevention of other non-communicable diseases such as diabetes type 2, cardiovascular diseases, osteoporosis, age-related cataracts, etc., that share many common risk factors with cancer. The most substantial impact of primary cancer prevention is judged to be that related to the linked exposures of body fatness and physical activity, which are related with many major cancers (cancer in colorectum, breast, esophagus (adenocarcinoma), kidney, gallbladder, pancreas and endometrium). In addition, vegetables and fruit, high dietary fiber intake and mainly plant-based diet with limited consumption of red meat and avoidance of processed meat, as well as limited consumption of alcohol, have been also shown to decrease risk of several cancer types. Primary cancer prevention complemented by earlier detection and more effective treatment has a potential to progress cancer control markedly. However, present social and economic trends do not promote prevention and global preventive initiatives need leadership and vision from policy makers. It is important to integrate individual health promotion with effective preventive strategies involving structural interventions.

Key words: cancer incidence; cancer prevention; diet; lifestyle; cancer control

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S.III.2.

Selenium and cancer

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Selenium is a trace element, which is an essential component of many enzymes that play an important role in several major metabolic pathways and ameliorate environmental insult, including the antioxidant defense system, the immune system and functioning of the thyroid gland. There is a range of serum selenium levels associated with the lowest rate of all cause mortality – the levels should be maintained at an optimal level and be neither too low nor too high. Selenium intake varies, largely based on the selenium content of food. The mean level of selenium in the population varies considerably between countries. Thus, for some countries selenium supplementation should be considered whereas for others it could be contraindicated. Recent meta-analyses indicate unequivocally that selenium supplementation of people with low initial serum selenium levels decreases the incidence of cancer incidence by approx. 35% and of cancer mortality by almost 50%. Additionally, it appears that in Se-deficient countries selenium levels may be a useful marker to select patients for cancer surveillance using for example computerized tomography for detection of the earliest stages of bronchial malignancy and colonoscopy for detection of the early stage colorectal cancer.

Summary points: It has become clear that both too low and too high selenium levels in the body are harmful.

It appears that optimal selenium supplementation is population specific as the background selenium levels vary between populations. Studies evaluating medical applications of selenium use have achieved major progress mainly due to the observation that optimal levels of selenium are required and that this correlates with a reduction of overall mortality and risk of cancer as well. The use of selenium for human health will be even greater if the genotypes, which can be used to individualize the optimal levels of selenium for each person, are identified. The evidence accumulated to date provides a strong rationale for the optimization of selenium levels to improve the results of cancer treatment and that selenium levels can also be used as a marker to identify high cancer risk groups of patients that may be useful in the selection of persons for screening examinations.

Key words: selenium; cancer; risk

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S.III.3.

Diet, lifestyle and genetic determinants of colorectal cancer risk: translational studies in Scotland

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Colorectal cancer risk has been associated with exposure to dietary carcinogens, while fruit and vegetable consumption is protective. Many polymorphic drug metabolising enzymes metabolise dietary carcinogens or chemopreventive agents. In a study of UK-based colorectal cancer patients (n=500) and age and sex-matched population controls, we demonstrated that meat consumption (odds ratio (OR) 1.51, 95% CI 1.03, 2.23; red meat OR 1.97, 95% CI 1.30, 2.98) was associated with increased risk, while fruit (OR 0.6, 95% CI 0.4, 0.9) and vegetable (OR 0.7, 95% CI 0.5, 1.0) consumption was protective, using a modified EPIC food frequency questionnaire to estimate diet. NAT2 genotype, or genotypes of additional enzymes associated with the metabolism of dietary heterocyclic amine carcinogens produced by meat cooked at high temperatures, did not influence risk. We did however identify significant case-control differences for CYP1A1*2C (OR 2.15, 95% CI 1.36, 3.39) and GSTM1*2 (OR 1.53, 95% CI 1.16, 2.02), suggesting that risk may be influenced by polycyclic aromatic hydrocarbon carcinogen exposure. The protective effects of vegetable consumption were modified by GSTT1 genotype (heterozygote OR 0.6, 95% CI 0.4, 0.96; homozygote OR 0.3, 95% CI 0.1, 0.6 for the GSTT1 gene deletion), suggesting that chemopreventive chemicals e.g. isothiocyanates may be present at higher concentrations in individuals with compromised GSTT1 activity. Access to unique patient cohorts recruited from the UK NHS colorectal cancer screening programme allowed us to extend our analysis to patients with pre-malignant colorectal adenomas (n=300 case/control pairs), where we confirmed reduced risk associated with fruit (p=0.02), vegetable (p=0.001) and folate (p<0.001) consumption, again modified by genotype. The impact of a targeted body weight and physical activity intervention (BeWEL) was additionally assessed in colorectal adenoma patients (n=329), reporting significant differences in various outcome measures including BMI, blood pressure and blood glucose levels, and highlighting the potential for lifestyle related risk reduction.

Key words: colorectal cancer; colorectal adenoma; diet; genotype; intervention study

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S.III.4.

Coffee consumption and DNA integrity

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Coffee is reported to be among the most widely consumed beverages in the world. It contains a multitude of compounds from the green bean as well as those generated by processing including phenolics, roasting-associated components, purine alkaloids and soluble fiber as major components. Epidemiological and experimental evidence increasingly suggests coffee consumption to be correlated with a decreased risk of degenerative diseases, such as diabetes type 2, Parkinson disease cardiovascular disease and certain types of cancer.

In two independent human interventions studies we investigated effects of regular coffee consumption on DNA integrity in peripheral white blood cells (WBC) by the comet assay [1, 2]. During four weeks, volunteers daily ingested three large cups (250 ml) of a specific coffee blend, rich in both, green bean constituents and roast products. Controls received the same volume of water. The results allow the conclusion that regular coffee consumption is associated with markedly reduced DNA strand breaks, reflecting total as well as background DNA damage. The conclusion that daily coffee consumption is associated with safeguarded DNA integrity finds support by results from earlier studies. Previously published intervention trials with coffee reported a similar decrease of total DNA strand breaks as well as decrease of DNA damage induced by activated forms of chemical carcinogens in isolated lymphocytes [3, 4, 5].

Data provides evidence that regular coffee consumption protects DNA from damages.

Key words: DNA-strand break; white blood cells; coffee

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S.III.5.

Blue-berried honeysuckle, a promising cancer preventing fruit; Polish genotypes as a source of bioactive phytochemicals

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From the ancient times, plants containing health-oriented compounds in their matrices have been used in the treatment of different complaints and diseases. One of these groups are plant secondary metabolites (PSM), especially phenolic compounds, terpenes and terpenoids. A large number of PSM exhibit cytotoxicity against a variety of tumor cells, as well as cancer preventive and anticancer efficacy in preclinical animal models. For this reason, the scientists are looking for new plants containing bioactive phytochemicals. Our interest concentrated on blue-berried honeysuckle (*Lonicera caerulea L.*), which is a relatively new and not well characterized cultivar grown in Poland. Its berries were shown to decrease the risk of cardiovascular diseases and various forms of cancer. These health benefits are ascribed to the high content of antioxidants. However, there is still no full characteristics of the antioxidant and terpene profiles determining the healthiness of these berries. Therefore, we undertook the study to determine and compare the phytochemical composition and antioxidant capacity of the berries of different blue-berried honeysuckle cultivars harvested at two plantations in Northern Poland. The chemical properties including content of phenolic and terpene compounds, antioxidant activity, profiles of antioxidants obtained by HPLC post-column derivatization or TLC, and composition of anthocyanins and other polyphenols were verified. The antioxidant activity of analyzed berries varied among cultivars and were ranging from 170 to 417 μmol TE/g dm in ABTS and from 93 to 166 μmol TE/g dm in DPPH and Folin-Ciocalteu's tests. The highest antioxidant activity in all tests was observed for the Jolanta cultivar from Osielsko and the lowest for the Brazowa cultivar from the same plantation. The major anthocyanin in Polish genotypes was cyanidin-3-glucoside, which constituted 84–92% of the total anthocyanins. The total content of anthocyanins and polyphenols were in the range of 13−35 g and 15–41 g per 100 g fw, respectively. The TLC and HPLC antioxidant profiles indicated that anthocyanins are the major antioxidants in all berries studied. The employment of GC×GC-TOFMS revealed the complex terpene profile of berries that included 18 monoterpenes, 3 sesquiterpenes, 54 terpenoids, and 11 norisoprenoids. The main component of the terpene fraction was eucalyptol with a concentration ranging from 57 to 351 μg/kg fw. The berries of blue-berried honeysuckle are also a good source of minerals, especially potassium (199–402 mg/100 g fw). Among the cultivars studied, the most promising health-promoting potential can be ascribed to the Jolanta variety from Osielsko.

Key words: blue-berried honeysuckle; antioxidant activity; nutrients; polyphenols; anthocyanins; mono- and sesquiterpenes

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