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Research on bioactive compounds at MTT Agrifood Research Finland

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The Biomolecules team of MTT's Biotechnology and Food Research unit produces valued research on the occurrence of food biomolecules and their health effects. We focus on the development of new, innovative, health promoting and sustainable food solutions with an emphasis on the identification and exploitation of bioactive molecules delivering potential health-promoting effects. Current areas of specialization are e.g. polyphenols and other secondary metabolites, proteins, bioactive peptides, vitamins and fibre. For example, fruits, berries, mushrooms, vegetables as well as the utilization of food processing side streams are studied.

Our research team has extensive methodological know-how, which covers multiple chemical, immunological, biochemical, microbial and preclinical analyses and various isolation technologies. Some of the chemical methods have been accredited. Our unit has a R&D pilot plant, equipped with a selection of food processing and fractionation equipment, e.g. pasteurization, fermentation, enzymatic modification, extraction (including pilot scale CO₂ extraction), separation, filtration, emulsification, spray-drying, and micro-encapsulation. In addition to ordinary laboratory facilities, MTTBiotechnology and Food Research houses several state of the art GC-MS, LC-MS and UHPLC-qTOF-MS for analytical purposes.

BERRIES ARE GOOD FOR YOU

Polyphenols are secondary metabolites found in plants. Research indicates that these compounds may have many beneficial health effects. These include e.g. a decreasing the risk of cardiovascular disease, cancer, memory diseases and diabetes. We have studied polyphenols since the 1990s. In 2003 we started a comprehensive collaboration project with the University of Kuopio to analyse the polyphenol contents of over 140 food stuffs of plant origin.



According to the study berries stood out as a superior source of polyphenols. The top 20 list included almost all common edible berries. This data was entered into the national Finnish Food Composition Database (<http://www.fineli.fi>). The data also enabled us to estimate the intake of polyphenols from Finnish diet. Although berries contain high levels of polyphenols they have quite a low impact on the total intake of these compounds, because the consumption of berries is relatively low. However, berries are a very important source of ellagitannins and coloured polyphenols, anthocyanins.

After our basic study we have co-ordinated or participated in several studies concerning berries and the utilization of berry side streams, e.g. press cakes and leaves. In addition to polyphenol research the effect of berries on blood pressure has been studied *in vivo* in a hypertensive rat model and the inhibitory effect on the angiotensin converting enzyme *in vitro*, for example. The antimicrobial effect of berries has also been studied.

MYSTERIOUS MUSHROOMS

According to Pirjo Mattila's doctoral studies (1992-1995) some wild mushrooms (especially the *Chantarellus*

CONTENTS

▶ FRONT PAGE

▶ EDITOR'S WORDS

ORGANISATION

▶ International Society of Nature and Forest Medicine

CURRENT RESEARCH

- ▶ Intensifying wild berry production in Finnish boreal forests
- ▶ Research on bioactive compounds at MTT Agrifood Research Finland
- ▶ Increasing evidence of beneficial effects of nature on health

▶ FORTHCOMING EVENTS

▶ SELECTED PUBLICATIONS



species) contained a surprisingly high natural content of vitamin D2 while cultivated mushrooms contain only traces of this vitamin. Wild mushrooms are exposed to sun light while cultivated mushrooms are usually grown in the dark. It was deduced that illumination conditions affect the vitamin D contents. In 1998-2001 we performed a project which aimed to optimize the illumination conditions to increase vitamin D levels in cultivated mushrooms. We were successful; it was possible to produce vitamin D2-rich cultivated mushrooms using UVB illumination.



Mushrooms are a rich source of ergosterol, which can be converted to vitamin D2 by treatment with UV light, presenting a new and convenient dietary source of vitamin D2.

Since the above project we have become very enthusiastic about fungi which we think are still an understudied and mysterious kingdom. Mushrooms have a long and established history of use as traditional Oriental therapies. Out of the 14 000 mushroom species known to date, about 700 are known to possess significant pharmacological effects, including anti-microbial, anti-viral, immunomodulating, cancer preventing, anti-atherogenic and hypoglycemic effects. Cultivated species have been far more extensively studied than the wild forest species and little is known about the potential biomolecules and health effects of Finnish edible forest mushrooms. Even knowledge of the proximate composition and nutritional content of mushrooms need to be updated using modern analytical methods.

We are currently launching mushroom research at MTT by analysing abundantly used edible Finnish forest mushrooms for the nutritional composition and bioactive compounds that are known to exert significant health-promoting effects in Asian medicinal mushrooms. In addition, the anti-inflammatory properties of edible mushrooms in an *in vitro* human leukocyte model are currently under study.

Many side streams of the wood industry as well as other non-wood forest products have a wide variety of bioactive compounds which may be valuable in the future. Some of them could have a high potential to be used in plant protection against various garden pests e.g. insects or fungal pathogens. They could have potential also in the pharmaceutical, food and feed industries, for example. However, the safety of many of these components has not yet been studied and the regulatory status has to be qualified before their use in food production.

MTT Agrifood Research Finland produces and disseminates scientific research information and develops and promotes the transfer of new technology for the agriculture and food sector. MTT, the Finnish Forest Research Institute (Metla), the Finnish Game and Fisheries Research Institute (RKTL) and the statistical services of the Information Centre of the Ministry of Agriculture and Forestry (Tike) are to be merged under a new entity called the Natural Resources Institute Finland as of 1 January 2015.

[◀ Back](#)

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