PHYTOCHEMICAL POTENTIAL OF BLUEBERRIES AND OPINIONS ON THEIR IMPORTANCE FOR BALANCE IMPROVING AND HEALTH SUPPORTIN OLDER AGE

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Abstract

The presented study is focused on contemporary knowledge and concepts concerning health benefits of the blueberries on the human health. They compare their effects on the brain and nervous system and on the mnestic, cognitive and sensory functions (with a special regard to the sight), locomotor functions (with a special regard to the balance and gait), antisclerotic, cardioprotective and angioprotective effects, potential anti-cancer effects and general protective effects (with a special regard to the ageing process). Contents of micronutrients present in the blueberries for the health are detailed. Differences in the importance of micronutrients and further effective substance are explained based on the RDA (Recommended Daily Allowance) value. Basic and well attainable literature is quoted, which offers detailed outlines of effective phytochemical substances in the bilberry and of the botanic classification and variations.

Keywords

European blueberries, Vaccinium myrtillus, importance for human health, prevention, mental functions, physical functions, ageing

1 INTRODUCTION, THEORETICAL BACKGROUND

Berry soft fruits in general, especially blueberries (blueberry cranberry, Vaccinium myrtillus), are a potent source of polyphenols, micronutrients and fiber (Beattie et al., 2005; Giongo et al., 2006; . The classification, nomenclature and terminology of individual cranberry / Vaccinium cultivars are detailed by Gionga et al. (2006). In their extensive report, they refer to the properties of 58 genotypes in typical horticultural features and 38 genotypes in terms of polyphenols. While the micronutrients - especially vitamins and fibre - have a significant role in the nutritional value of their food intake, polyphenols in berries of domestic origin are somewhat overshadowed by the ongoing interest in the so-called French paradox, namely the positive influence of red wine on human health et al., 2008). In general, dark coloured fruits contain polyphenols, which they owe both their colour (blue, purple, red) and the positive health effects of phytochemical ingestion when ingested into the organism (Symposium of Summaries of the Communication, 2002, Beattie et al., 2005; Giongo et al., 2006; Ronis et al., 2006; Quideau et al., 2011).

Polyphenols have the character of phytoalexins in plants - they are substances that prevent plants from being harmful to pests and pests. Therefore, rich vines / grapes of vines, infested with nocturnal mold (Botrytis cinerea) (Delmas et al., 2006), are polyphenols. Micronutrients are those food components that cause deficits when they are absent in the diet. It is therefore possible to determine the recommended daily allowance - the recommended daily allowance (RDA). As for micronutrients, it is necessary to emphasize that blueberries are such a significant source of vitamin C that literally a "handful" of blueberries will provide RDA in an adult human (Beattie et al., 2005). The authors, in a concise brief form, summarize current knowledge and ideas about the beneficial effects of blueberries on human health. They deal with their effects on the brain and the nervous system, as well as on the functions of mnestic, cognitive, sensory - with special regard to sight, movement - with special regard to balance and walking, antisklerotic, cardio- and angioprotective effects, potential antiinflammatory effects and overall protective effects - with particular regard to the aging process - aging. The content of micronutrients in blueberries is discussed in detail. The difference between the health significance of micronutrients and other active substances is explained and explained on the basis of the indicator - RDA (recommended daily allowance). In detail, reference is made to basic and well-available literature providing a detailed overview of both phytochemicals in blueberries and their botanical classification and variation. The history of domestication of blueberries is briefly reminded. Reference is made to the interconnection of applied research in agriculture and health care to maximize the beneficial effects of the diet containing blueberries on human health.

Other micronutrients in blueberries are B vitamins and folic acid. Blueberries are therefore a good, affordable and important nutritional factor that can lower homocysteine levels, thus helping to reduce the risk of neuronal disorders in neonates, the incidence of ischemic heart disease and possibly tumors (Beattie et al., 2005; Basu et al. 2010; Quideau et al., 2010). Unlike micronutrients, polyphenols are a group of substances that have a beneficial effect on human health but which cannot be determined by RDA and whose low intake does not produce symptoms of deficiency. Polyphenols, present in blueberries and other berries such as anthocyanins, flavonoids and resveratrol, can thus be likened to drugs. From the pharmacological point of view, it is "xenobiotics" and their supply to the organism is referred to as phytochemical intake. Generally, the beneficial effect of polyphenols is due to their ability to deliver hydrogen from their hydroxyl groups to free radicals, thereby reducing their high oxidation capacity (Balík et al., 2008).

One of the most recent and perhaps most interesting findings is the fact that specific binding sites for polyphenols, including resveratrol, exist in the mammalian brain (Han et al., 2006). This is apparently the basis for the beneficial effect of polyphenols on the brain and nervous system. Even in humans, such beneficial effects are observed, particularly in relation to neurological disorders that occur more often with increasing age. These are, for example, macular degeneration, stroke and dementia (Han et al., 2006). It is particularly encouraging to note that dietary

supplementation with blueberries has protective effects on ischemic brain damage (Wang et al., 2005). The positive effect of bilberry on neurological function, especially on dysfunction, is reported by Beattie et al. (2005). They document that the beneficial effects of blueberries on age-related learning disabilities, memory functions, motoric ability and neuronal excitement are induced (Beattie et al., 2005). An overview of the beneficial effects of blueberries in the sense of slowing brain aging and brain function is provided by Greenwell in the Life Extension Magazine article of March 2000 (Greenwell, 2000). Recent advances in the demonstration of the beneficial effects of blueberries, which are able to prevent the decline of cognitive functions that occurs with increasing age, are documented by Willis et al. (2009). A good-looking nickname for blueberries is "true eye-openers" in Anglo-Saxon literature.

Blueberries are still referred to as arsenic publicly available sources as a means of positively influencing eyes and visus (Herbs, 2012). The beneficial effect of blueberries on eyesight is explained both by favourable effects on rodopsin (Greenwell, 2000) and by optimization / reduction of glycemia, especially in diabetics. Night vision and its possible positive influence on blueberries is currently being studied by the research group dr. Wilhelmina Kalt at the Atlantic Food and Horticultural Research Centre, Kentville, Nova Scotia, Canada (Kalt, 2010).

2 OBJECTIVES

In view of demographic trends, the main objective of the study is to analyse the potency and importance of blueberries in the context of their generally protective effect on the human organism that prevents aging (anti-ageing effect).

The next objective is to analyse the effects of blueberry consumption on balance promotion in seniors and reduce the risk of falls. Blueberries have a proven or reasonably anticipated beneficial effect on the brain and the nervous system in humans, on the functions of mnestic and cognitive functions. Senses, especially sight, are also beneficial. They have a beneficial effect on maintaining balance and on the ability of rhythmic regular walking. Tinetti has developed, validated, and in practice tested a diagnostic tool to quantify the risk of falls due to impaired ability to maintain balance (Tinetti, 2003). This tool is available and used in the Czech version (Topinková, 2005). The same tool is used by the authors of this statement.

3 METHODS

The method of review includes both preventive and possible curative use of traditional plant natural product in practice. There is a background material that illuminates the current interest in blueberries in the world of electronic, publicly available information and resources. A detailed analysis and syntheses, inductive and deductive aspects of the available experimental material in both the animal and human experiments provides an approximate effective daily dose of blueberries in humans (120 ml native berries - Vaccinium myrtillus, per person per day). These include collagen production, hormone synthesis, immune system activity, iron absorption, thrombocyte aggregation / aggregation, thrombus formation and formation, and preventive

effects against ischemic heart disease, osteoporosis, and tumour diseases.

4 ANALYSES AND SYNTHESES OF RESULTS

Improving the balance associated with blueberries

Improving balance is probably due not only to their direct effect on nerve tissue but also to their effect improving spatial imagination and memory (Bauer, 2011). For the direct effect of blueberries on the ability to maintain balance with increasing age, a subtle and convincing experimental model was created. A specially developed rat, the so-called Fisher rat, is an excellent model for studying the effect of the age on the balance. Rats of this type are at the age of 19 months old that corresponds to the human age of 60 to 65 years. If we serve blueberries at a dose that would give 120 ml of blueberries in a raw state per day, we find that after 2 months - at the age of 21 months, which corresponds to the age of 70-75 years - practically did not get older ability to maintain balance. The group of experimental animals that were treated with blueberries will maintain the balance twice more than the group without this intervention. The results are surprising and encouraging the phytochemicals (polyphenols) in blueberries can improve both neuronal function and overall brain activity. Their positive effect is documented in particular on memory (Beattie et al., 2005; Bauer, 2011).

Blueberries and cardiovascular system

The beneficial effects of polyphenols, phytochemicals from soft berries, on the cardiovascular system are best known for grapes and wines (Balík et al., 2008). Blueberries, however, do not fall behind their better known competitors. In both research and epidemiological research projects, the beneficial influence of bilberry on cardiovascular health is documented (Basu et al., 2010). Detailed reviews, conceived as a nutritional epidemiological survey, lead to encouraging findings on the beneficial effects of phytochemicals on the human cardiovascular system. Data from the Interheart study summarizes dietary habits and eating patterns from 52 countries around the world. They show an indirect proportion between the content of fruit and vegetables in the diet and the occurrence of acute myocardial infarction (Basu et al., 2010). Here is a large field of activity, especially for the field of nutrition therapist. Even in the United States, where the public campaign to increase fruit and vegetable consumption has been in place since 2001, the situation is not favourable. For example, in a group of 2 757 overweight diabetics, a significant risk group for cardiovascular disease, less than 50% of the respondents consume the minimum recommended daily dose of fruit and vegetables. Comparing the situation in the US and France, it appears that adult French have a significantly higher consumption of fruit and vegetables than adult Americans.

An indirect proportion of blueberry intake and the incidence of calculated risk for cardiovascular disease, expressed as CVD-related deaths, are demonstrated. People with the highest intake of blueberries consumed more than 408 grams of berry crops a day, people with the lowest intake of less than 133 grams a day. Laboratory markers should highlight low levels of haptoglobin in people with high consumption of blueberries. From the point of view of gender issues, we mention a large

non-interventional epidemiological study of 34,489 post-menopausal women in the Iowa Women Health Study (USA) and a women health care study in the Women Health Study, which included 38,176 women. It can be concluded that eating blueberries at least once a week leads to a significant decrease in Relative Risk of cardiovascular death (Basu et al., 2010). In addition to these epidemiological surveys and surveys, the results of the intervention studies are also available. For the year 2010, 20 such intervention studies have been documented, dealing with the influence of berries on cardiovascular health. Blueberries, domesticated blueberries, black currants, cranberries, raspberries and strawberries were studied (Basu et al., 2010). Significant results of these studies are the finding that blueberries (and other fruits) reduce oxidative stress, increase serum antioxidant capacity, reduce LDL (low density lipoprotein), and reduce lipid peroxidation. In particular, the influence of blueberries on postprandial oxidative stress is emphasized. Similar or identical conclusions about the influence of blueberries on oxidative stress also occur in Schmidt et al. (2005), Lotito and Frei (2006), Quideau et al. (2011) and Xie et al. (2011). The importance of this intervention in oxidative stress and the beneficial effect on lipid metabolism is seen especially in the antisklerotic effect of blueberries, which help to prevent the occurrence of atherosclerosis (Beattie et al., 2005, Schmidt et al., 2005; 2011; Xie et al., 2011).

Positive effect of blueberries on the treatment of inflammation

In addition to oxidative stress and lipid metabolism, markers of inflammation are also highlighted as a risk factor or directly the mechanism of atherosclerotic changes. In 2010, Annette Karlsen collected extensive documentation of the beneficial effects of polyphenols in blueberry juice on the serum or plasma reduction of inflammatory biomarkers present. Reduction of CRP, IL-6, IL-15, MIG and TNF-alpha (Karlsen et al., 2010) is demonstrated. With particular regard to the ant proliferative activity of polyphenols from blueberries, Barbara M. Schmidt (Schmidt et al., 2005) deals with this problem as well.

Significant and quantifiable beneficial effects of blueberries on human metabolism

The antioxidant effects of blueberries are facilitated by the fact that polyphenols contained therein provide free radicals in the human body with hydrogen from their hydroxyl groups (Balík et al., 2008). They reduce LDL oxidation and lipid peroxidation (Basu et al., 2010). In the experiment on the animal (home pig), Dr. Wilhelmina Kalt's direct effect of eating blueberries to lower cholesterol levels in interfering individuals. In a study at the Atlantic Veterinary College in Charlottetown, Prince Edward Island, Canada, they gave pigs a diet rich in sugars and induced hypercholesterolemia. This has been avoided if the addition of blueberries has been added to the daily dietary supplement (Kalt, 2010). Polyphenols from different berries, especially blueberries, lead to a direct reduction of glycaemia in the intervened individuals (Greenwell, 2000). This finding is also consistent with the ancient folk practice recommending blueberries in diabetics. The US Department of Agriculture has ranked research on the influence of polyphenols on insulin metabolism and on glycaemic activity as the

first priority in the AR Agricultural Research Service (ARS-US Dept. of Agriculture, 2010) interdisciplinary research plan. Particular attention is paid to the discovery and surprising findings of the work group of Chena, et al from 2010 that polyphenols improve bone metabolism and bone growth. In the in vitro model, in tissue cultures, they show an increase in osteoblast activity and higher bone marrow additions while reducing osteoclast activity (Chen et al., 2010).

The particular positive significance of this phenomenon lies in the fact that it thus intensifies and accelerates the degradation of carcinogens in the body (phase I), thus allowing and amplifying their excretion (Phase II). Blueberries and anti-tumour effects Julie Beattie of Dundee University highlights the possible beneficial antitumor effects of blueberries in her extensive work. Especially in cancer-type tumours, direct effects of bilberry and other soft berry extracts on carcinoma cells are demonstrated in in vitro experiments. Meanwhile, these in vitro accumulated results cannot be convincingly reproduced in an animal experiment (Beattie et al., 2005). Is also the finding that the effect of resveratrol is greatly prolonged over time, as explained by its relatively high plasma protein binding. Resveratrol does not have its own cytotoxic effect, but sensitizes tumour cells against cytotoxic agents. These findings will undoubtedly be the basis of consideration of new or innovative strategies of cytostatic therapy and chemotherapeutic protocols (Delmas et al., 2006). Undoubtedly, the antitumor potential also has the influence of blueberries on metabolism as described above.

5 DISCUSSION AND CONCLUSIONS

To avoid of the processes and manifestations of biological and psychological aging in the sense of achieving inhibition of function deficits is a great challenge for health and social work. The age carries with it the risks of social exclusion. Any intervention, which in general prevents the aging of the organism or its effects slows down, is therefore certainly sought and welcomed. In the following, we summarize the above-mentioned partial information in relation to age and aging. Blueberries are an important tool in these efforts due to the content of micronutrients and phytochemicals. Thanks to their antioxidant potential, they generally have a protective / protective effect on the tissues. This is particularly evident in the cardiovascular and nervous system. Improving the balance and thus preventing falls is an important contribution to safe aging. It is also linked to the fact that blueberries improve spatial imagination and spatial memory. Improving mnestic and cognitive functions is very desirable in old age. Memory that is prominent in old age suffers from micronutrients and blueberry phytochemicals being favourably influenced and strengthened. Blueberries are already a solid part of the armamentaria for prolonging life while preserving its quality - Life Extension (Willis et al., 2009, Greenwell, 2000, Kalt, 2010, Bauer, 2011). In 2005, the beneficial effect of blueberries on cellular immunity, in particular the increase of NK cells (Natural Killers) and T-lymphocytes in general (Beattie et al., 2005), was described. The influence of heat treatment and cooking The phytochemical properties of blueberries are a source of phytochemicals as a source of phytochemicals, especially because they are

used not only in the raw state as refreshing fruits and possibly as a compote or juice, but also in the form of ready meals such as typical South Bohemian blueberries cakes and blueberry dumplings. It is gratifying and delighting to find that heat cooking, but also freezing or cooling, does not destroy the phyto-chemical potential of blueberries. Cooling, freezing and heating to 98-100 ° C does not lead to a significant reduction in the content of polyphenols in beans (Beattie et al., 2005; Schmidt et al., 2005). The most heat treatment is heated to 92-98 ° C for 0.5 to 2 minutes, in the form of so-called optimized thermal hydro thermodynamic treatment (Satanika, 2011).

The heat treatment in which blueberries are exposed to temperatures above 190 °C and which last longer than 18 minutes results in a reduction in polyphenols, in particular resveratrol, of 17 to 46% (Lyons et al., 2003). Blueberries as a subject of applied interdisciplinary research Along with the development of the concept of "functional food" (Petr, Kalová, 2006) there is a growing focus on soft berry berries in general and on blueberries in particular (ARS-US Department of Agriculture, 2010). It is emphasized that it is a fruit of local origin, in domestic / local traditional cuisine (Beattie et al., 2005). The US Department of Agriculture has ranked the research of polyphenols in these fruits first and second in the priorities of the Nutrition - Human Nutrition research (ARS-US Department of Agriculture, 2010). In the first place, polyphenols are investigated in relation to diabetes, especially their effect on insulin and glucose metabolism in general. The second place is the research of blueberries and their influence on aging and cognitive function. Applied research in these contexts has become so appealing that there are companies that are manufacturing placebo in the industry, having the appearance, colour and taste of blueberry powder.

CONCLUSIONS

The accumulated knowledge of the beneficial effects of blueberries on human health and evidence of this influence in many areas of the human bio-psycho-social dimension cannot be left to the level of scientific knowledge and applied research. Another logical and necessary step is to transform this knowledge in comprehensible and accessible form into information that will be the basis for boarders and caterers - for health education at all levels. Perhaps the first favourable step in this direction is the composition of a team of authors, in which medical experts (clinical pharmacologist, clinical biochemist, gerontologist / geriatric) meet with other health professions (a nurse focusing on patient education, university education, pharmacist assistant) together with experts from the sphere of self-government and marketing.

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