

Editorial

ONCE AGAIN ABOUT HEALTHY NUTRITION AND ITS ROLE IN PREVENTION OF TYPE 2 DIABETES

Amorin R. Popa^{1,✉}, *Loredana Popa*²

- ¹ Clinic of Diabetes and Internal Diseases,
Emergency Clinical County Hospital Oradea
² Clinic of Diabetes, Nutrition and Metabolic Diseases,
Emergency Clinical County Hospital Cluj Napoca

Education concerning nutrition and healthy eating is very important in our lives in order to maintain and even improve our health, furthermore we have to acknowledge that by following an healthy lifestyle we can prevent future diseases: excessive weight gain and obesity, metabolic diseases and diabetes as well as cardiovascular and even oncologic diseases. Cardiovascular diseases are among the leading causes of death, according to the World Health Organization' -WHO- statistics reports. Annually, 10 percent of deaths are due to heart diseases. Obesity has increased three times in the last 10 years in the Romanian population and is one of the major risk factors for developing type 2 diabetes, high blood pressure and cardiovascular diseases, all of the above mentioned being highly prevalent in Romania.

Metabolic diseases have negative consequences for the individual, but also for his family and his professional and social group. That's why lifestyle changes are necessary to reduce the risk of metabolic disorders. The appropriate diet contributes to

the improvement of the quality of life as well as the maintenance of good health.

Scientific evidence from clinical trials proves the important role of a healthy diet for the biological and psychological development of the individual, but also for the prevention of type 2 diabetes, involved in the epidemic spreading in the last 30 years. In older age-groups, diabetes has reached epidemic numbers and the epidemic is expected to grow. This is mainly due to an increasing proportion of aged people in the worldwide population [1]. Other aggravating factors are obesity in general, and increased ratios of abdominal fat distribution [2]. It is considered that more than half (60-90%) of new cases are due to obesity and weight gain [3].

Prevention of diabetes is crucial to lowering disease incidence, and thus minimizing the individual, familial, and public health burden. Dietary habits are the personal decisions individuals make when choosing their nutrition. Nutrition therapy is generally recommended for primary, secondary and tertiary prevention [4]. Primary prevention means intervention before the development of

✉ corresponding author e-mail: popa_amorin@yahoo.com

diabetes, secondary prevention refers to the time after diagnosis of diabetes, and tertiary prevention can take place when significant numbers of beta-cells remain after diagnosis. Primary prevention is particularly important in type 2 diabetes, because the time of diagnosis and the severity of the disease course can be influenced beneficially by changing daily lifestyle and dietary practices. However, despite this awareness, there is still no universal dietary approach for diabetes prevention and management [4].

Evidence is accumulating that whole-grain products are beneficial to health, and protect against chronic diseases (mainly cancer and cardiovascular disease). In a meta-analysis including six cohort studies with 286.125 participants and 10.944 cases, a two-serving-per-day increment in whole-grain intake was associated with a 21% reduction in risk for type 2 diabetes [4,5].

Another large meta-analysis confirm the above results by showing reduced risk for type 2 diabetes with higher cereal fiber intake [4,6]. Schultze and colleagues have speculated that both insoluble and soluble fibers could play a role in diabetes prevention [4]. Whole grain intake is inversely associated with risk of type 2 diabetes, and this association is stronger for bran than for germs (decreasing risk with 21%). The effect is partly mediated by effects on body weight, but also by higher cereals fiber intake and intake of lignans. The consumption of whole grains in many populations is very low, an average of one serving per day for US adults [4,8] and even less in British adults [4,9], suggesting that increased consumption has the potential to contribute substantially to reducing risk of type 2 diabetes in these populations.

In the same paper, the authors found that the intake of fruit and vegetable fibers did not significantly reduce the risk for type 2 diabetes [6]. Also in accord with these results, a meta-analysis including 167.128 participants and 4858 incident cases of type 2 diabetes, with a mean follow-up period of 13 years, showed that the consumption of fruit and vegetables provided no protection from type 2 diabetes [4,7].

Frequent meat consumption has been shown to increase the risk of developing type 2 diabetes. In a meta-analysis of 12 cohort studies, the estimated summary relative risk of diabetes comparing high to low intake was 1:17 for total meat, 1:21 for red meat and 1:41 for processed meat [4,10].

Non-oil-seed pulses (chickpeas, beans, peas, lentils etc.) are another good protein source. They seem to help with glycemic control, both in diabetic and non-diabetic subjects [4,11]. In a total of 41 trials, when pulses alone were examined, fasting blood glucose and insulin were both lowered.

Fish consumption has also been analyzed for its relation to diabetes. Fish oil supplementation at an amount of 3 to 18 g/day in diabetics was not found to have any statistically significant effect on fasting glucose and HbA1c [4,12].

Some beverages have been evaluated for their effect on diabetes prevention. Coffee intake (mainly drip-filtered coffee) was found to have a protective effect. In 9 cohort studies comprising 193.473 participants and 8394 incident cases of type 2 diabetes, the lowest relative risk was for the highest consumption (≥ 6 or ≥ 7 cups per day) and for the second highest (4-6 cups per day) categories of coffee consumption, when compared with the lowest

consumption category (0 to ≤ 2 cups per day) [4,13]. Probably due to its antioxidant components, coffee can be a significant contributor to the total antioxidant capacity of the diet needed to reverse oxidative stress. Oxidative stress could lead to favorable conditions for type 2 diabetes.

Tea consumption was analyzed in a meta-analysis comprising 9 cohort studies, including 324,141 participants and 11,440 incident cases of type 2 diabetes. They did not show an association with reduced risk for type 2 diabetes. However, in the same review, stratified analysis suggested that tea consumption of ≥ 4 cups per day may lower the risk of developing type 2 diabetes [4,14].

It seems that the relationship between alcohol intake and diabetes incidence is U-shaped. A meta-analysis of 32 studies comprising a time period of 37 years (from 1966 to August 2003) suggested that moderate consumption (one to 3 drinks/day) is associated with a 33% to 56% lower incidence of diabetes and a 34% to 55% lower incidence of diabetes-related coronary heart disease. In contrast, heavy consumption (> 3 drinks/day) was associated with a 43% increased diabetes incidence [4,15]. Even in diabetics, moderate alcohol consumption did not acutely impair glycemic control [4,15].

Resveratrol is a natural compound suggested to have beneficial health effects. However, people are consuming resveratrol for this reason without having the adequate scientific evidence for its effects in humans. Scientific valid recommendations concerning the human intake of resveratrol were formulated after the Resveratrol 2010 conference, held in September 2010 in Helsingør, Denmark [16].

Resveratrol occurs naturally in low amounts in various edible plants (berries, peanuts), but the fact that Resveratrol is found in red wine increases its relevance as being accessible to the general population. These levels are low, less than 4 mg.

Recommendations for the use of Resveratrol [16]:

1. There are not yet unequivocal scientific data for the effect of Resveratrol as a disease preventative substance in humans nor for human life extension.
2. There are no valid data on the toxicity of chronic intake of Resveratrol in humans.
3. A relevant or optimal dose for Resveratrol has yet to be established by human studies.
4. There is sufficient evidence for a chemopreventive effect of Resveratrol on the development of cancer in skin of mice. There are promising results in the prevention of colon cancer in animals.
5. There is sufficient evidence to suggest Resveratrol improves insulin sensitivity, reduces blood glucose levels, and reduces high fat diet-induced obesity in rodents.
6. Resveratrol is well tolerated in rats and no toxicological effects are observed up to 700-1000 mg/kg bw/day.
7. Published evidence today is not sufficiently strong to justify recommendation for the chronic administration of Resveratrol to human beings.

8. Nuts are rich in mono- and polyunsaturated fats, and vegetable proteins are generally regarded as part of a healthy diet. However, there seems to be no protective effect associated with the consumption of nuts. Intervention studies on the relation of nuts to type 2 diabetes have not shown any improvement in glycemic indices. However, nuts reduce postprandial oxidative stress [4,17].

Chromium is one of the top-selling supplements in the United States. According to a meta-analysis including 15 reports of randomized controlled trials published in 2002, chromium supplementation does not affect glucose or insulin concentration among non-diabetic subjects [4,18].

Magnesium seems to function at the insulin receptor level. Hypomagnesaemia has been associated with increased diabetes risk [6].

A meta-analysis relating antioxidant intake from vitamins C and E, flavonoids, and carotenoids to diabetes risk included 9 cohort studies, comprising 139,793 participants and 8813 incident cases of type 2 diabetes. The mean follow-up was 13 years. The protective effect was related to vitamin E intake and total carotenoid intake [4,7].

In vitro and in vivo studies have shown that cinnamon is an insulin sensitizer, mainly activating insulin receptor kinase. According to a meta-analysis, five prospective randomized controlled trials (n = 282) did not show beneficial effects of cinnamon on HbA1c or fasting blood glucose [4,19].

In prediabetics (with impaired glucose tolerance, IGT, and/or impaired fasting

glucose, IFG), chinese herbal medicine in combination with lifestyle modification was more effective in returning fasting plasma glucose to normal levels than lifestyle changes alone. Furthermore, individuals consuming those herbs had lower progression rates to diabetes [4,20].

The exact proportion of carbohydrate inclusion in diabetic adults diets on a daily basis has been the subject of intense analysis. It has been hypothesized that a restricted-carbohydrate dietary pattern is beneficial for type 2 diabetes. A meta-analysis included 19 randomized studies with 306 patients to investigate the effects of two prescribed diets, a low-fat, high-carbohydrate (LFHC) diet and a high-fat, low-carbohydrate (HFLC) diet. HbA1c and fasting blood glucose values were found to be similar in the two groups. In contrast, replacing fat with carbohydrate deteriorated insulin resistance, which in turn increased fasting insulin by 8% [21]. HbA1c, fasting glucose, and some lipid fractions (triglycerides) were improved with low carbohydrate diets (defined as having 45% or less of their total calories from carbohydrates) [4,21]. High carbohydrate high fiber diets were compared with low carbohydrate or low fiber diets in diabetic individuals, been associated with lower values for fasting, postprandial and average plasma glucose, HbA1c LDL – and HDL – cholesterol, and triglycerides [22]. Thus, a diet with more than 55% carbohydrates and 25-50 g/day of dietary fibers, protein intake of 12-16%, and fat intake of < 30% (with monounsaturated fat 12-15%) is regarded as beneficial [4,22].

In 23 randomized controlled trials , 1075 participants with type 2 diabetes were examined in relation to beneficial effects of

polyunsaturated fatty acids (PUFA). It was found that omega-3 supplementation significantly lowered triglycerides and VLDL cholesterol, whereas LDL cholesterol, glycemic control and fasting insulin were unaffected [4,23].

Trans-fatty acids are harmful available in abundance, as in the diets of western industrialized countries. They promote insulin resistance and risk to develop type 2 diabetes [4,24].

The Mediterranean diet was first described in the 1960s by Ancel Keys. The Mediterranean dietary pattern emphasizes a consumption of fat primarily from foods high in monounsaturated fatty acids and mainly olive oil and encourages daily consumption of fruits, vegetables, low fat dairy products and whole grains, weekly consumption of fish, poultry, tree nuts, legumes, monthly consumption of red meat, as well as a moderate consumption of alcohol, normally with meals. There is no single Mediterranean diet, but prevail many common characteristics. Total lipid intake may be high as in Greece (around 40% of total energy intake), or moderate as in Italy (around 30% of total energy intake) [25, 26, 27].

The Mediterranean diet is one of the best known dietary patterns for its beneficial effects on human health and seems to have pleiotropic effects that may act beneficially against the development of type 2 diabetes, including reduced oxidative stress and insulin resistance [25].

Results from epidemiological studies show the beneficial effect of the Mediterranean dietary pattern on diabetes mellitus and glucose metabolism in general. According to a large prospective study of

13.380 Spanish university graduates, a traditional Mediterranean food pattern was associated with a significant reduction of 83% in the risk of developing type 2 diabetes [28].

After decades of epidemiological, clinical and experimental research, it has become clear that consumption of Mediterranean dietary pattern rich in olive oil has a profound influence on health outcomes, including obesity, metabolic syndrome and diabetes mellitus. Traditionally, many beneficial properties associated with oil have been ascribed to its high oleic acid content. Olive oil, however, is a functional food that, besides having high-monounsaturated (MUFA) content, contains other minor components with biological properties. In this line, phenolic compounds have shown antioxidant and anti-inflammatory properties, prevent lipoperoxidation, induce favorable changes of lipid profile, improve endothelial function, and disclose antithrombotic properties [30].

Polyphenols, including flavonoids, phenolic acids, proanthocyanidins and resveratrol, are a large and heterogeneous group of phytochemicals in plant-based foods, such as tea, coffee, wine, cocoa, cereal grains, soy, fruits and berries. Polyphenols and foods or beverages rich in polyphenols have attenuated postprandial glycemic responses and fasting hyperglycemia, and improved acute insulin secretion and insulin sensitivity. The possible mechanisms include the inhibition of carbohydrate digestion and glucose absorption in the intestine, stimulation of insulin secretion from the pancreatic β -cells, modulation of glucose release from the liver, activation of insulin receptors and glucose uptake in the insulin-sensitive tissues,

and modulation of intracellular signaling pathways and gene expression [30].

On the other hand, a Paleolithic diet (a diet consisting of lean meat, fish, shellfish, fruits and vegetables, roots, eggs and nuts, but not grains, dairy products, salt or refined fats and sugar) was associated with marked improvement of glucose tolerance while control subjects who were advised to follow a Mediterranean-like diet did not significantly improve their glucose tolerance, despite decreases in weight and waist circumference [29].

Consumption of sugar-sweetened beverages, which include soft drinks, iced tea, fruit drinks, and energy and vitamin water drinks has been associated with weight gain and risk of overweight and obesity, but in addition is associated with development of metabolic syndrome and type 2 diabetes [31].

Consumption of sugar-sweetened beverages has been steadily increasing across the globe. Sales figures from Coca Cola's 2007 annual report show that during 2007, India and China experienced growths of 14 and 18%, respectively, the volume of beverages sold [31,32].

Sugar-sweetened beverages are composed of energy-containing sweeteners such as sucrose, high-fructose corn syrup, or fruit juice concentrates all of which have essentially similar metabolic effects [31,33]. Because of the high content of rapidly absorbable carbohydrates such as sucrose (50% glucose and 50% fructose) and high-fructose corn syrup (most often 45% glucose and 55% fructose), in conjunction with the large volumes consumed, sugar-sweetened beverages may increase the risk of metabolic syndrome and type 2 diabetes not only

through obesity but also by increasing dietary glycemic load, leading to insulin resistance, β -cell dysfunction and inflammation [31,34]. Additional metabolic effects of these beverages may also lead to hypertension and promote accumulation of visceral adipose tissue and of ectopic fat due to elevated hepatic de novo lipogenesis [31,35], resulting in the development of high triglycerides and low HDL cholesterol and small, dense LDL.

Fructose, which is a constituent of both sucrose and high-fructose corn syrup in relatively equal parts, is preferentially metabolized to lipid in the liver, leading to increased hepatic de novo lipogenesis, the development of high triglycerides, low HDL cholesterol, small, dense LDL, atherogenic dyslipidemia, and insulin resistance [31,36], accumulation of visceral adiposity or ectopic fat deposition [31,35]. In contrast, some studies have shown greater satiety and lower total energy intake after intake of fructose-containing beverages compared with glucose beverages [37]. Ghanim et al. [38] found evidence of oxidative and inflammatory stress after intake of glucose but not fructose or orange juice.

Fructose has also been shown to increase blood pressure, an effect not observed with glucose administration or consumption of aspartame-sweetened beverages [31,39,40]. Fructose is also the only sugar able to increase blood uric acid and to develop gout [31,41].

Milk intake is widely recommended for a healthy diet. An inverse association of daily intake of dairy products, especially low-fat dairy, with type 2 diabetes was revealed, indicating a beneficial effect of dairy consumption in the prevention of diabetes [42]. The different analysis revealed a 14%

reduction in type 2 diabetes risk in population with highest consumption of dairy products compared with the lowest intake.

There is a wealth of data to suggest that nutrition therapy is a powerful tool for primary prevention of type 2 diabetes and to minimize associated risk. Additionally, many studies have shown that intensive lifestyle

interventions are important in diabetes prevention. These interventions include weight reduction, dietary counseling, and physical activity. The effectiveness of this intervention strategy has been ascertained by comparing it with treatment by antidiabetic drugs.

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