Available online at www.sciencedirect.com

ScienceDirect

Agriculture and Agricultural Science Procedia 8 (2016) 713 – 717

Agriculture and Agricultural Science Procedia

Florence "Sustainability of Well-Being International Forum". 2015: Food for Sustainability and not just food, FlorenceSWIF2015

Nutrition and prevention of chronic-degenerative diseases

Francesco Sofi[a,b,c,*], Monica Rodica Dinu[a]

[a]*Department of Experimental and Clinical Medicine, University of Florence;*
[b] *Unit of Clinical Nutrition, University Hospital of Careggi, Florence, Italy;*
[c] *Don Carlo Gnocchi Foundation, Florence, Italy*

Abstract

Over the last years, numerous evidence on the existing relationship between nutrition and chronic degenerative diseases have led investigators to search for the optimal dietary pattern to maintain a good health status. It's well known, in fact, that nutrition is capable of substantially modifying the risk profile of a subject in primary and/or secondary prevention. Several models of diet have been imposed on public attention, but the one that got the most interest is certainly the Mediterranean diet. Recently, several studies have shown that a strict adherence to a Mediterranean dietary pattern is associated with a lower incidence of mortality and incidence of chronic degenerative diseases such as cardiovascular disease and cancer. Meta-analyses conducted by our group have revealed, in a population of over than 2 million of people, that adherence to Mediterranean diet determines a significant reduction on the risk of cardiovascular and cerebrovascular accidents.

To the best of the knowledge the most effective indications for an optimal therapeutic strategy in nutrition include: increase the consumption of fruits and vegetables up to the recommended 5 servings a day, prefer whole grains, replace saturated and trans fats with unsaturated fats, reduce the consumption of sugar and sweetened beverages, and limit salt intake. With these simple indications, together with recommendations of following the principles of the traditional Mediterranean diet, a substantial reduction of the risk of incidence and / or mortality from cardiovascular disease can be easily obtained.

Peer-review under responsibility of Fondazione Simone Cesaretti

Keywords: Nutrition, Food, Prevention, Disease

* Corresponding author.
E-mail address: francescosofi@gmail.com

Peer-review under responsibility of Fondazione Simone Cesaretti
doi:10.1016/j.aaspro.2016.02.052

1. Introduction

Nutrition is able to alter the health status of the general population. The World Health Organization, in fact, strongly emphasized the role of unhealthy eating habits, along with sedentary lifestyle and cigarette smoking as a risk factor for the onset of chronic diseases such as cardiovascular disease, cancer, respiratory and metabolic disorders (WHO Study group, 2003).

In industrialized countries such as Italy the most important association between diet and health is certainly the relationship with cardiovascular disease, the leading cause of death and disability. The ability to identify with certainty, therefore, the relationship between diet and cardiovascular disease appears to be a key element in the implementation of specific primary prevention strategies.

The first evidence of association between diet and physical well being was found in the 60s' following the first results of a study named the Seven Countries' Study (Keys et al., 1986). The first results of this study were surprising because they clearly showed that the countries of the Mediterranean basin (Italy and Greece) had the lowest incidence of death from cardiovascular disease and cancer than all other countries. From here the Mediterranean diet concept came out.

2. What are the cornerstones of this diet?

The main characteristics of this diet, summarized today in the iconography of the famous food pyramid are: daily consumption of carbohydrates and plant foods (fruits, vegetables, grains, nuts and legumes), olive oil as the main source of fat, low consumption of red meat, moderate consumption of wine, normally with meals.

In recent years, several studies have shown that strict adherence to a healthy dietary pattern, such as that characteristic of the Mediterranean diet is associated with a lower incidence of mortality.

Trichopoulou et al. (2003) in the New England Journal of Medicine have documented, in a population of 22.043 individuals followed for 44 months, that the mortality risk is inversely correlated with the grade of adherence to Mediterranean diet assessed by a score. It was observed that an increase of 2 points in this score was significantly associated with a reduction of 25% of global mortality (3). These results were confirmed in two meta-analysis performed by our group, which showed a population of over 2,000,000 people that an increase of 2 points of adherence to the Mediterranean diet led to a substantial reduction of overall mortality, of mortality and / or incidence of cardiovascular diseases, neoplastic diseases, as well as of neurodegenerative diseases like Parkinson's and Alzheimer's diseases (Sofi et al., 2008; 2010).

In recent years, however, despite the pressing claims of adherence to a nutritional profile similar to that of the classic Mediterranean diet the Mediterranean populations and in particular Italy has gradually lost their grade of adherence to Mediterranean diet in favour of a more Westernized diet.

The science of diet and chronic disease is relatively young, spanning perhaps only half a century. New advances offer substantial evidence from complementary research paradigms on cardiometabolic effects of specific dietary factors. Several recent evidence-based reviews conducted in conjunction with national and international policy-making efforts provide the context for the present report. The need to prioritize selected foods and overall dietary patterns rather than only individual nutrients, the relevance of carbohydrate and fat quality as well as quantity, the effects and policy implications of sodium consumption, the importance of energy balance, and the role of dietary supplements represent several key findings of interest. Evidence-based insights into successful individual and public health strategies for behavior change are also addressed. Overall, the present report is intended to provide a useful framework for health practitioners and policy makers to understand contemporary issues related to the effects of diet on CVD.

3. Fruits and Vegetables

In randomized controlled trials (RCTs), diets that emphasize consumption of fruits and vegetables produce substantial improvements in several risk factors, including blood pressure (BP), lipid levels, insulin resistance, inflammatory biomarker levels, endothelial func- tion, and weight control (He et al., 2006). Benefits do not appear reproducible with equivalent amounts of representative mineral and fiber supplements, nor are they dependent on

dietary macronutrient (fat, protein, or carbohydrate) composition. This evidence suggests that benefits might be derived from: (1) a more complex set of micronutrients, phytochemicals, and fiber found in fruits and vegetables; (2) potentially enhanced bioavailability of these nutrients in their natural state; and/or (3) replacement of less healthful foods in the diet. In long-term observational studies, greater fruit and vegetable consumption are each associated with lower incidence of coronary heart disease (CHD), and greater fruit consumption is associated with lower incidence of stroke. The results of RCTs of physiological measures and prospective cohorts of disease outcomes together provide strong concordant evidence that fruit and vegetable consumption lowers cardiovascular risk. Potential differences in health effects contributed by specific types of fruits, vegetables, or their juices require further investigation.

4. Whole Grains

Although no single accepted definition of whole grain exists, whole grains generally comprise bran, germ, and endosperm from the natural cereal. Bran contains soluble and insoluble dietary fiber, B vitamins, minerals, flavonoids, and tocopherols; germ contains numerous fatty acids, antioxidants, and phytochemicals. Endosperm provides largely starch (carbohydrate polysaccharides) and storage proteins. The type and extent of processing appear to modify the health effects of grain and carbohy- drate consumption. For example, removal of bran and germ reduces dietary fiber that has important benefits, including lowering of blood pressure and cholesterol levels; increases bioavailability and rapidity of digestion of remaining endosperm, which increases glycemic responses; and eliminates minerals, micronutrients, and other phytochemicals that may have additional indepen- dent health benefits.

In RCTs, consumption of whole grains improves glucose- insulin homeostasis and endothelial function and possibly reduces inflammation and improves weight loss (Mellen et al., 2008). Consumption of whole grain oats reduces low-density lipoprotein (LDL) cholesterol without reducing high-density lipoprotein cholesterol or raising triglycerides. Consistent with physiological benefits, greater whole grain consumption is associated with lower incidence of CHD, diabetes mellitus, and possibly stroke. The higher dietary fiber in whole grains contrib- utes to these benefits. In RCTs, increased dietary fiber reduces serum triglycerides, LDL cholesterol, blood glucose, and blood pressure. Emerging evidence supports additional independent contributions to health from other characteristics of whole grains, including slower digestion (lower glycemic responses) and higher content of minerals, phytochemicals, and fatty acids. Thus, similar to fruits and vegetables, health effects of whole grains may result from synergistic effects of multiple constituents that are unlikely to be matched by supplemental fiber alone, added bran, or isolated micronutrients.

5. Fish

Fish and other seafood contain several healthful constituents, including specific proteins, unsaturated fats, vitamin D, selenium, and long-chain omega-3 polyunsaturated fatty acids (PUFAs), which include eicosapentaenoic acid (EPA; 20:5 omega-3) and docosahexaenoic acid (DHA; 22:6 omega-3). In humans, EPA and especially DHA are synthesized in low amounts (5%) from their plant-derived precursor, linolenic acid (18:3 omega-3). Thus, tissue levels of EPA plus DHA are strongly influenced by their direct dietary consumption. Average EPA plus DHA contents of different seafood species vary by 10-fold. Fatty (oily) fish such as anchovies, herring, farmed and wild salmon, sardines, trout, and white tuna tend to have the highest concentrations.

In vitro and animal experiments suggest that fish oil has direct antiarrhythmic effects, but trials to establish direct antiarrhythmic effects in patients with preexisting arrhythmias have been inconsistent. In human trials, fish oil lowers triglyceride levels, systolic and diastolic blood pressure, and resting heart rate. Observational and RCT evidence suggests that fish or fish oil consumption may also reduce inflammation, improve endothelial function, normalize heart rate variability, improve myocardial relaxation and efficiency, and, at high doses, limit platelet aggregation (Nannicini et al., 2008).

Consistent with these physiological benefits, habitual fish consumption is associated with lower incidence of CHD and ischemic stroke, especially risk of cardiac death, among generally healthy populations. Compared with no fish consumption, consumption of 250 mg/d EPA plus DHA from fish is associated with 36% lower CHD mortality.

Fish and fish oil are among only a handful of dietary factors for which both long-term observational studies and RCTs of CVD outcomes have been performed. Four of 8 large RCTs of fish or fish oil, including participants with and without prevalent heart disease, documented significant reductions in CHD events. Several of these RCTs had relevant limitations. In meta-analyses of RCTs, fish oil supplementation significantly reduced cardiac mortality, including fatal CHD and sudden cardiac death. Overall, these findings are concordant with long-term observational studies of habitual fish intake in generally healthy populations and with physiological benefits of fish or fish oil in intervention studies.

6. Dairy Foods

Some short-term RCTs have evaluated the potential benefits of dairy consumption for satiety or weight loss, with inconsistent and inconclusive findings. Multicomponent di- etary interventions that included daily intake of low-fat dairy foods significantly lowered BP, lipid levels, and insulin resistance and improved endothelial function, independent of changes in weight. In such multicomponent interventions, the specific benefits of dairy foods cannot be quantified separately. Nonetheless, consistent with physiological bene- fits, higher dairy consumption was associated with lower risk of both stroke and diabetes mellitus in long-term observational cohorts.

The active constituents for such cardiometabolic benefits are not established. On the basis of lower content of calories, saturated fatty acids, and cholesterol, together with no established nutritional advantage of whole-fat dairy, most dietary guidelines and scientific organizations recommend low-fat or nonfat dairy consumption. These guidelines generally recommend dairy foods as a source of selected nutrients (eg, calcium, vitamin D, protein, potassium, magnesium, and other vitamins) rather than based on equally or more relevant evidence for their effects as a whole food that may reduce cardiometabolic risk. In long-term observational studies, a lower risk of diabetes mellitus and metabolic abnormalities has been variably linked to con- sumption of low-fat dairy, whole-fat dairy, or both. Conjugated linoleic acid and calcium were proposed as potential mediators, but RCTs have demonstrated very small benefits or even adverse cardiometabolic effects of these factors.

7. Indications for an optimal diet

Despite the increasing information on diet and dietary habits, a progressive change in local dietary habits has been observed. Hence, major scientific associations, including WHO, have reported indications for optimal dietary choices in terms of prevention of chronic degenerative diseases, which include the following recommendations.

1. *Limit excessive caloric intake from any sources*. Given the importance of obesity and overweight in the causation of many chronic diseases, avoiding excessive consumption of energy from any source is fundamentally important. Because calories consumed as beverages are less regulated than calories from solid food, limiting the consumption of sugar-sweetened beverages is particularly important (Malik et al., 2010).
2. *Increase the consumption of fruits and vegetables*. Strong evidence indicates that high intakes of fruits and vegetables are associated with a reduced risk of cardiovascular diseases including stroke, as well as of many of the most important types of cancer. Moreover, fruits and vegetables represent the major source of fiber and a relevant source of vitamins, particularly B-group and antioxidant vitamins.
3. *Favour the consumption of cereal products in their whole-grain, high-fiber form*. Consuming grains in a whole-grain, high-fiber form has double benefits. First, consumption of fiber from cereal products has consistently been associated with lower risks of cardiovascular diseases and type 2 diabetes, which may be because of both the fiber itself and the vitamins and minerals naturally present in whole grains. High consumption of refined starches exacerbates the metabolic syndrome and is associated with higher risks of cardiovascular diseases and type 2 diabetes. Second, higher consumption of dietary fiber also appears to facilitate weight control and helps prevent constipation.
4. *Replace saturated and trans fats with unsaturated fats, including sources of omega-3 fatty acids*. Replacing saturated fats with unsaturated fats will reduce the risk of cardiovascular diseases by reducing serum low-density lipoprotein (LDL) cholesterol. Also, polyunsaturated fats (including the long-chain omega-3 fish oils and probably alpha-linolenic acid, the primary plant omega-3 fatty acid) can prevent ventricular arrhythmias and

thereby reduce fatal coronary artery disease. Trans fatty acids produced by the partial hydrogenation of vegetable oils have uniquely adverse effects on blood lipids and increase risks of cardiovascular diseases.

5. *Limit consumption of sugar and sugar-based beverages*. Sugar (free sugars refined from sugarcane or sugar beets and high-fructose corn sweeteners) has no nutritional value except for calories and, thus, has negative health implications for those at risk of overweight. Furthermore, sugar contributes to the dietary glycemic load, which exacerbates the metabolic syndrome and is related to the risk of diabetes and CHD. WHO has suggested an upper limit of 10 percent of energy from sugar, but lower intakes are usually desirable because of the adverse metabolic effects and empty calories.
6. *Limit sodium intake*. The principle justification for limiting sodium is its effect on blood pressure, a major risk factor for stroke and coronary disease. WHO has suggested an upper limit of 1.7 grams of sodium per day (5 grams of salt per day) (Strazzullo et al., 2010).

In conclusion, there is a vast amount of literature, to date, that reports a healthy dietary habit to be one of the strongest preventive measures for the general population as well as for the population of patients with a manifested disease. Diet is able to decrease the risk of mortality and reduce the incidence of some of the most important disease states, but also is able to determine a better and longer life with a better psychological well-being and a higher perceived health status.

References

He, F.J., Nowson, C.A., MacGregor, G.A., 2006. Fruit and vegetable consumption and stroke: meta-analysis of cohort studies. Lancet 367, 320-6.

Keys, A., Menotti, A., Karvonen, M.J., Aravanis, C., Blackburn, H., Buzina, R., Djordjevic, B.S., Dontas, A.S., Fidanza, F., Keys, M.H., 1986. The diet and 15-year death rate in the Seven Countries Study. Am J Epidemiol 124, 903-15.

Malik, V.S., Popkin, B.M., Bray, G.A., Després, J.P., Willett, W.C., Hu, F.B., 2010. Sugar-sweetened beverages and risk of metabolic syndrome and diabetes mellitus type 2: meta-analysis. Diabetes Care 33, 2477-83.

Mellen, P.B., Walsh, T.F., Herrington, D.M., 2008. Whole grain intake and cardiovascular disease: a meta-analysis. Nutr Metab Cardiovasc Dis 18, 283-90.

Nannicini, F., Sofi, F., Avanzi, G., Abbate, R., Gensini, G.F., 2006. Alpha-linolenic acid and cardiovascular diseases. Omega-3 fatty acids beyond eicosapentaenoic acid and docosahexaenoic acid. Minerva Cardioangiol 54, 431-42.

Sofi, F., Cesari, F., Abbate, R. Gensini, G.F. Casini, A., 2008. Adherence to Mediterranean diet and health status. A meta-analysis. BMJ 337, a1344.

Sofi, F., Abbate, R., Gensini, G.F., Casini, A., 2010. Accruing evidence about benefits of adherence to Mediterranean diet on health: an updated systematic review with meta-analysis. Am J Clin Nutr 92, 1189-96.

Strazzullo, P., D'Elia, L., Kandala, N.B., Cappuccio, F.P., 2009. Salt intake, stroke, and cardiovascular disease: meta-analysis of prospective studies. BMJ 339, b4567.

Trichopoulou, A., Costacou, T., Bamia, C., Trichopoulos, D., 2003. Adherence to a Mediterranean diet and survival in a Greek population. N Engl J Med 348, 2599-608.

World Health Organization Study Group. 2003. Diet, Nutrition, and the Prevention of Chronic Diseases. Geneva, Switzerland: World Health Organization; Technical Report Series, 916.