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EMAS position statement: Diet and health in midlife and beyond

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ABSTRACT

Introduction: There is increasing evidence that life-style factors, such as nutrition, physical activity, smoking and alcohol consumption have a profound modifying effect on the epidemiology of most major chronic conditions affecting midlife health.
Aims: To provide guidance concerning the effect of diet on morbidity and mortality of the most frequent diseases prevalent in midlife and beyond.
Materials and methods: Literature review and consensus of expert opinion.
Results and conclusions: A healthy diet is essential for the prevention of all major chronic non-communicable diseases in midlife and beyond, both directly, through the effect of individual macro- and micronutrients and indirectly, through the control of body weight. Type 2 diabetes mellitus is best prevented or managed by restricting the total amount of carbohydrate in the diet and by deriving carbohydrate energy from whole-grain cereals, fruits and vegetables. The substitution of saturated and trans-fatty acids by mono-unsaturated and omega-3 fatty acids is the most important dietary intervention for the prevention of cardiovascular disease. Obesity is also a risk factor for a variety of cancers. Obese elderly persons should be encouraged to lose weight. Diet plans can follow the current recommendations for weight management but intake of protein should be increased to conserve muscle mass.

The consumption of red or processed meat is associated with an increase of colorectal cancer. Adequate protein, calcium and vitamin D intake should be ensured for the prevention of osteoporotic fractures. Surveillance is needed for possible vitamin D deficiency in high risk populations. A diet rich in vitamin E, folate, B12 and omega-3 fatty acids may be protective against cognitive decline. With increasing longevity ensuring a healthy diet is a growing public health issue.

1. Introduction

Life expectancy is continuously increasing worldwide. In most European countries both men and women are expected to live beyond 80 years [1]. Longevity is the result of an improved socioeconomic environment and advanced medical care and is progressively leading to an aging society. This demography has shifted the etiology of morbidity and mortality from accidents, violence and infections toward chronic non-communicable diseases. In high-income countries, 9 out of the 10 leading causes of death fall into this category, most importantly cardiovascular disease, diabetes mellitus, cancer and dementia [2]. Life-style factors, such as nutrition, physical activity, smoking and alcohol consumption have a profound modifying effect on the epidemiology of most major chronic conditions affecting midlife health [3]. The aim of this position statement is to summarize the evidence and to provide

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guidance concerning the effect of diet on morbidity and mortality of the most frequent diseases prevalent in midlife and beyond.

2. Diet and morbidity in midlife and beyond

2.1. Obesity

Overweight and obesity are the result of in imbalance between energy intake and energy expenditure. This position statement focuses on the energy intake. Obesity is a major health epidemic worldwide. Despite public health interventions obesity figures continue to rise: currently there are 300 million obese adults worldwide, while half of the total global population is above normal weight [4]. Obesity, in particular central adiposity, reduces life expectancy in both sexes [5]; on the other hand centenarians are on average leaner compared to older adult controls [6]. Obesity is a strong risk factor for cardiovascular disease (CVD), diabetes mellitus, cancer, respiratory dysfunction, urinary incontinence, arthritis and dementia [7]. As a person grows older, however, body mass index (BMI) may not be representative of the adiposity status due to (a) decreasing height and (b) decreasing lean mass due to inactivity, hormonal decline or chronic medical conditions. Low lean mass, described as "sarcopenia", may itself be a risk factor for morbidity and furthermore may mask increased central adiposity, particularly prevalent in the elderly [7]. This is the major factor contributing to the "obesity paradox": while it is clear that obesity, as defined by high BMI, increases all-cause mortality in the general adult population, the evidence concerning the elderly is less convincing, with individuals in the range of overweight exhibiting better survival rates compared to persons with BMI < 25 [5].

Obese elderly persons should be encouraged to lose weight. Diet plans should follow the current recommendations for weight management (low saturated fat, fat energy derived from mono- and polyunsaturated fat, carbohydrate energy derived from vegetable, fruits, beans, and whole-grain cereals, pasta or rice, protein energy derived mainly from fish, poultry, plants or skimmed dairy products) [8]. Management of elderly people, however, should differ from the general adult population with regard to the following points (1) indices of body composition and of central adiposity should be set as monitoring variables beyond BMI, (2) a higher proportion of protein should be incorporated as an energy source in daily caloric planning and (3) resistance exercise, tailored to the individual needs and abilities should be incorporated into the weight management program for the preservation of lean mass [9].

2.2. Diabetes mellitus type 2

Diabetes mellitus type 2 (DM2) accounts for 3% of all-cause mortality in the modern world and is a strong risk factor for cardiovascular disease, renal insufficiency, visual loss and neuropathy [2]. Weight reduction has a profound beneficial effect at all stages of developing DM2, namely metabolic syndrome, impaired glucose tolerance, impaired fasting glycemia as well as in the management of overt diabetes [10]. Although high-carbohydrate/low fat diets were traditionally recommended to diabetics, it is increasingly being appreciated that low carbohydrate/high protein diets may offer a better long-term option concerning weight and metabolic control [11]. The most important aspect in prevention and management of DM2 is the restriction of the quantity of carbohydrates as energy source in the daily planning [12]. The fiber content of the diet, particularly insoluble fiber contained in whole grain cereals, has an inverse association with plasma glucose levels, insulin resistance and the risk of developing DM2 [13]. Possible mechanisms are the increased rate of passage through the GI tract, thus decreasing the absorption of macronutrients, the secretion of gastrointestinal insulinotropic hormones, the increase of satiety sense and finally the decrease of free fatty acids in the circulation resulting in augmented intracellular glucose transport [14]. Saturated short-chained fatty acids, included mainly in meat and whole-fat dairy products, increase insulin resistance and progression to diabetes. On the contrary, mono-unsaturated long-chained fatty acids, contained in olive oil, are associated with better glycemic control and lower incidence of diabetes [15,16]. Omega 3-polyunsaturated fatty acids contained in fish oil probably have no effect on glucose metabolism beyond their indirect insulin-sensitizing effect through triglyceride lowering [17]. Moderate alcohol drinking (up to 1 drink daily for women and up to 2 drinks daily for men) is reported to have a lowering effect on DM2 incidence and on mean glucose levels in diabetics, possibly by improving insulin sensitivity [16,18]. Although many reports indicate a possible beneficial effect of micronutrient supplements, such as chromium, magnesium, zinc, potassium and antioxidants, the current evidence is not sufficient to support their recommendation in routine clinical practice [16,19].

2.3. Cardiovascular disease

Cardiovascular disease (CVD) is the leading cause of death worldwide. Ischemic heart disease, stroke and hypertensive heart disease account together for one third of all-cause mortality in high-income countries [2]. CVD is the best disease model where lifestyle modifications can have a profound effect on primary and secondary prevention. Although this has long been appreciated by authorities and much progress has been made with regard to cardiovascular mortality reduction, prevention programs are still inadequate, in particular among women [20]. The most important nutritional factor in CVD prevention is the reduction of saturated fat to <7% and of trans fatty acids to <1% of the daily energy intake, since their consumption has consistently shown a strong linear association with coronary heart disease events and stroke, an effect mediated through atherogenic modifications of the lipid profile, insulin resistance, and pro-oxidative mechanisms [21,22]. Furthermore, the modification and not the reduction of the total fat in the diet appears to be associated with benefit with regard to cardiovascular outcomes [23]. In that context, the substitution of saturated fat with omega-3 polyunsaturated fatty acids found in oily fish, as well as of mono-unsaturated fatty acids found in vegetable oils such as olive oil reduces the incidence of acute coronary events, as well as the risk of cardiac death. [22,24]. Dietary cholesterol may not be as important as once thought [25]; American guidelines still limit the daily intake to 300 mg [26], while European guidelines do not have an upper limit [27]. Carbohydrates should not be consumed in excess, substituting saturated fat, as they may increase triglyceride levels, decrease high density lipoprotein (HDL)-c and compromise insulin sensitivity. Sources of carbohydrates should be fruits and vegetables, whole grain rice and cereals, nutrients rich in fiber. According to a recent meta-analysis based on prospective observational data, persons consuming >3 servings per day of foods containing fiber had 21% lower risk of CVD and less weight gain during 8–13 years of observation [13]. Salt intake should be limited, as indicated by its increasing effect on blood pressure. The effect of this intervention on cardiovascular mortality, however, has recently been challenged, as a Cochrane review failed to identify any benefit with regard to cardiovascular morbidity or all-cause deaths [28]. Although potentially beneficial, electrolytes, such as potassium and magnesium, as well as antioxidants, should not be routinely recommended for the prevention of CVD [29].

2.4. Cancer

Beyond smoking, weight management, diet and physical activity are the most important lifestyle parameters modifying cancer risk. Excess body weight, in particular central obesity, has consistently been associated with the risk of various cancers, such as postmenopausal breast cancer [30], endometrial cancer [31], colorectal cancer [32], renal cancer [33], as well as adenocarcinoma of the esophagus [34]. Positive associations with BMI have also been reported for cancers of the liver [35] and the prostate [36]. Obesity may affect tumorigenesis through various mechanisms, including chronic inflammation, compromised immune function, altered hormone metabolism such as insulin, insulin-like growth factor (IGF) and estrogens, as well as their binding proteins [37]. Healthy dietary patterns aiming to long-term weight control, low in saturated fat and energy dense nutrients and high in fruits, vegetables and beans should actively be recommended as a measure against cancer.

The consumption of red or processed meat has also consistently been associated with colorectal cancer, a leading cause of cancer death in both sexes. According to a recent meta-analysis, a daily intake of 50 g processed meat or 100 g red meat increases the risk of colorectal cancer by 15–20% [38]. Many mechanisms may account for this association, among which nitrite/nitrate addition in the processing of meat, nitrosamine formation catalyzed by the iron-containing heme of red meat, mutagens produced by high heat cooking or secretion of secondary bile acids induced by red meat [39].

Accumulating evidence indicates that the consumption of dietary fiber decreases the risk of various cancers including breast [40] and colorectal cancer [41]. Furthermore, large prospective studies have shown that a diet rich in fruit and vegetables may be protective against cancer [42,43]. Given their small magnitude, however, these associations should be interpreted with caution, since they may be confounded by lower smoking and obesity rates, or a healthier lifestyle in general of subjects who consume high amounts of fruit and vegetables.

Alcohol consumption, even in a small degree, is associated with cancer of the breast, mouth, larynx and gastrointestinal tract [44]. Alcohol interacts with smoking to a much higher risk than the risk conferred by the two factors alone [45]. Putative mechanisms explaining the effect of alcohol on cancer are its transformation to the mutagenic acetaldehyde, as well as the prolongation of sex steroid half-life by interference with liver enzymes [37].

At this time there is no evidence that dietary supplements including, minerals, vitamins and antioxidants have any effect in reducing cancer risk, so their use should not be recommended for cancer prevention [37].

2.5. Osteoporosis

Osteoporotic fractures have a life-time risk of 40% for women and 13% for men and account for considerable morbidity and mortality, posing thus a serious socioeconomic burden [46]. Calcium is vital for bone health throughout life. Inadequate dietary intake of calcium is associated with increases in osteoporotic fractures, in particular when vitamin D intake is also low [47]. Calcium supplementation alone can reduce the risk of osteoporotic fractures [48], though some investigators have challenged its efficacy [49]. High baseline calcium intake, poor adherence to treatment or vitamin D insufficiency may mask the effect of calcium supplementation on fracture risk. Analyses in vitamin D replete or compliant participants indicate a benefit from calcium supplementation with regard to fracture risk [46,49]. The current guidelines by most authorities suggest a daily intake of 1000–1200 mg of elemental calcium through either diet or supplementation [50]. However caution has been expressed in using calcium supplements in women whose diet is replete. Thus the Women's Health Initiative (WHI) study found an increased risk of kidney stones [51]. Also calcium supplement use is associated with an increased risk of myocardial infarction and, possibly, stroke [52]. This risk is not mitigated by co-administration of vitamin D. It is probably safer to achieve adequate through dietary modification rather than using supplements. Beyond dairy products, calcium-rich nutrients include small fish eaten with the skeleton, figs, tahini paste and sesame seeds [53].

Vitamin D is essential for optimal calcium absorption. Vitamin D deficiency increases bone turnover through secondary hyperparathyroidism and leads to bone loss [54]. Beyond its effect on bone metabolism, vitamin D may act beneficially on osteoporotic fractures by decreasing the risk of falls [54]. Dietary sources of vitamin D are rather limited and include oily fish and fortified dairy products [55]. The prevalence of vitamin D insufficiency may be high especially in the elderly, the obese, the dark skinned or the people with minimal exposure to sunlight. Given the safety of vitamin D supplementation, its efficacy along with calcium on fracture prevention [48] and its possible beneficial effect on neuromuscular and cardiovascular system [56], a daily allowance of 800 IU is recommended for optimal bone health [50]. Individuals with documented insufficiency may need higher doses to restore optimal serum vitamin D levels [54]. Cholecalciferol (D3) should be preferred over active metabolites of vitamin D, as the latter do not increase serum 25OH vitamin D, which is important for non-renal tissue production of active vitamin D, and they are associated with higher rates of hypercalcemia [57,58].

Protein intake, in particular of animal origin, has been positively associated with higher bone mineral density (BMD) as well as with lower rates of osteoporotic fractures and post-fracture complications [59,60]. This association may be mediated through higher calcium absorption, higher IGF-1 production and increased muscle mass induced by a high-protein diet [60,61]. Other studies have failed to corroborate this association, possibly due to low calcium intake in the population studied or to longevity bias, since persons with high protein intake may live longer and sustain more fractures [60]. In view of this evidence, the daily recommended allowance of 0.8 g protein/Kg body weight may not meet the needs for lean body mass preservation and healthy bone turnover, especially in the elderly [61,62].

High alcohol consumption is associated with decreased BMD and higher rates of osteoporotic fractures [60]. Alcohol acts directly by inhibiting bone formation and indirectly by increasing the risk of falls and of malnutrition [63]. Moderate drinking, however, has not been shown to affect negatively bone health [60,63].

2.6. Osteoarthritis

Osteoarthritis (OA) is a disabling, degenerative disease, which is more common in women than in men after the fifth decade [64]. Known risk factors for OA include age, gender and obesity. Weight reduction can reduce pain and improve mobility [65,66]. With regard to specific dietary components, some studies suggest that vitamin C and vitamin D may reduce disease progression, sympton severity and cartilage loss [67,68]. Polyphenols in olive oil and polyinsaturated omega-3 fatty acids may reduce inflammation [69].

Glucosamine and chondroitin supplements are popular dietary supplements used for OA. However the evidence supporting efficacy is poor with the Glucosamine/Chondroitin Arthritis Intervention Trial (GAIT) study investigators showing that the combination of glucosamine and chondroitin did little to alleviate the progression of disease or pain in people with mild to moderate knee OA and further studies are warranted [70,71].

2.7. Cognitive function

Much attention has been focused today on the possible effects of diet on the development and the progression of dementia. The most convincing evidence concerns the protective effect of vitamin E, folate, vitamin B12 and omega-3 fatty acids. Most studies examining the effect of dietary vitamin E intake on cognitive performance have found positive results, especially in populations with low dietary intake [72]. Beyond its antioxidant function, vitamin E may be involved in signal transduction, gene expression and redox sensing [73]. On the contrary, clinical studies investigating the use of vitamin E supplements have not documented any benefit [74]. Health-consciousness of trial participators with higher baseline vitamin E concentration or differences in dietary vitamin E activity, as compared to the supplemented may account for the observed lack of efficacy of supplements on cognitive function [72].

Folate and vitamin B12 are co-factors involved in the metabolism of homocysteine, an important modulator of the neurodegenerative process [72]. Low levels of these two vitamins, as well as increased circulating homocysteine have been associated with lower cognitive performance and higher risk of developing dementia [75,76]. As in the case of vitamin E, however, intervention studies have not demonstrated an efficacy of follate and vitamin B12 supplementation in preventing cognitive decline [75,77].

A diet rich in saturated fat is associated with faster cognitive decline and increased risk of dementia [72,78]. On the contrary, fish consumption, rich in omega-3 polyunsaturated fatty acids has been shown as protective against cognitive decline [78]. These effects may also be mediated through modifications in cardiovascular risk, in particular concerning vascular dementia [72]. Clinical trials and prospective intervention studies with omega-3 fatty acid supplementation have not shown so far an effect either on cognitive performance of healthy older people, or on the incidence and progression of dementia [79,80].

3. Healthy eating patterns

Early observations on differences in longevity and in the incidence of the major non-communicable disease by geographic variation led to the study of specific dietary patterns in health promotion [81]. The Mediterranean diet (Mediet) is the diet best studied and increasingly strong evidence supports its preventive effect on many midlife medical conditions [82]. Mediet is more a lifestyle philosophy than a mere combination of nutrients, consisting of frequent communal meals, daily moderate exercise and moderate red wine consumption along with meals [83]. Cooked or raw seasonal vegetables, beans and legumes, as well as moderate amounts of cheese, yoghurt and fish are the basis of the Meddiet. The avid consumption of olive oil characterizes Mediterranean eating habits. Meat is consumed rarely and saturated fat is usually less than 7% of the total daily calories [82]. Adherence to Mediet among Mediterranean populations has consistently shown a lower total, CVD and cancer mortality and possibly lower incidence of neurodegenerative diseases [84–87].

Vegetarian diets have gained popularity as a healthy way of living. Vegetarians have been shown to have lower all-cause mortality and lower incidence of coronary heart disease, diabetes and hypertension, an effect partially mediated by the lower BMI of vegetarians [88]. Data on cancer incidence and mortality are still inconclusive [88–91]. The difficulty in establishing associations lies mainly in the fact that the term “vegetarian” includes many diet patterns, namely lacto-ovo-vegetarians who consume animal products, pesco-vegetarians who consume fish and vegans who consume no meat, poultry, fish or animal products. The latter category is subject to deficiencies of vitamin D, calcium, vitamin B12, iron and zinc [88,91].

4. Conclusion

A healthy diet is essential for the prevention of all major chronic non-communicable diseases in midlife and beyond, both directly, through the effect of individual macro- and micronutrients and indirectly, through the control of body weight. Adequate protein intake should be ensured mainly from fish, poultry, low-fat dairy products or legumes. Carbohydrates should be derived from whole grain cereals, fruits and vegetables, nutrients rich in fiber, while the consumption of sugared or refined products should be discouraged. Saturated fat contained in red meat and whole-fat dairy products should be limited to <7% of the total calorie intake. Fat energy should be derived from plant oils, in particular olive oil which is rich in monounsaturated fatty acids. Moderate alcohol consumption may confer some benefit with regard to cardiovascular disease prevention. People, however, who do not consume alcohol should not be encouraged to do so on the sole basis of these findings. Beyond calcium and vitamin D supplementation for the prevention of fractures, currently there is no adequate evidence to support the use of supplements for the prevention of midlife chronic diseases.

5. Summary recommendations

- Diet may modify the epidemiology of the major midlife diseases, namely diabetes, cardiovascular disease, cancer, osteoporosis and dementia.
- Sarcopenic obesity in the elderly may be masked by a “normal” BMI and should be managed with adequate protein intake and tailored physical exercise.
- Diabetes mellitus type 2 is best prevented or managed by restricting the total amount of carbohydrate in the diet and by deriving carbohydrate energy from whole-grain cereals, fruits and vegetables.
- The substitution of saturated and trans-fatty acids by monounsaturated and omega-3 fatty acids is the most important dietary intervention for the prevention of cardiovascular disease.
- Obesity is a risk factor for a variety of cancers. The consumption of red or processed meat is associated with an increase of colorectal cancer.
- Adequate protein, calcium and vitamin D intake should be ensured for the prevention of osteoporotic fractures. Surveillance is needed for possible vitamin D deficiency in high risk populations.
- A diet rich in vitamin E, folate, B12 and omega-3 fatty acids may be protective against cognitive decline.
- Beyond calcium and vitamin D, routine supplementation of vitamins, antioxidants or micronutrients is not warranted at present for the prevention of chronic diseases.
- The Mediterranean diet is reported to protect against cardiovascular disease, cancer and possibly cognitive decline.
- Vegetarian diets are associated with lower incidence of diabetes, hypertension and cardiovascular disease.

Contributors

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