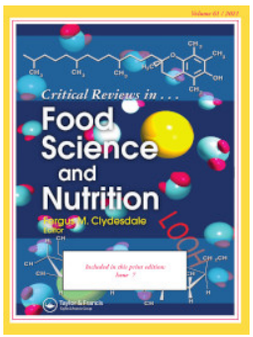

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REVIEW

Mediterranean diet as medical prescription in menopausal women with obesity: a practical guide for nutritionists

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ABSTRACT

Menopausal transition is associated with weight gain and increased visceral fat distribution, which acts as an endocrine organ secreting the pro-inflammatory adipocytokines, which leads to metabolic disorders typical of menopause, including type 2 diabetes and cardiovascular diseases. Given the increasing number of aging population, the nutritional strategies to prevent obesity and obesity-related diseases in menopausal women is becoming a growing need and it should be one of the main objective for Nutritionists. The Mediterranean diet is characterized from foods with anti-inflammatory and antioxidant actions, such as extra-virgin olive oil, vegetables, fruits, legumes, nuts, red wine, and whole-grain cereals. Several evidences showed that the Mediterranean diet acts on both weight control and menopause, in addition to the known effects of the Mediterranean diet on cardiovascular and metabolic diseases. The Mediterranean diet is comparable with pharmacological interventions in terms of reducing the risk of obesity and cardiovascular and metabolic events. Considering that there are no specific dietary guidelines to manage weight in menopause, the aim of this review is to provide a nutritional guideline for the management of weight in menopause, particularly focusing on the Mediterranean diet.

KEYWORDS

Mediterranean diet; menopause; obesity; nutritionist

Introduction

Menopause, i.e., the definitive disappearance of menstruation due to the exhaustion of ovarian activity, can be diagnosed after 12 months of amenorrhea and represents approximately one third of the woman's life (Minkin 2019). It is preceded by a phase called "menopausal transition" during which menstrual irregularities occur and symptoms of estrogen deprivation begin to arise, including especially vasomotor symptoms but also vaginal dryness/dyspareunia, sleep difficulties and adverse mood changes (Minkin 2019). Menopause is associated with a significant decline in plasma concentrations of estrogens and progesterone, an increase in the concentrations of the gonadotrophins follicle-stimulating hormone (FSH) and luteinizing hormone (LH) and a certain reduction in androgens which, being lower than that of estrogens, configures a condition of "relative hyperandrogenism" (Honour 2018). In turn Postmenopause is divided into two phases: early menopause that lasts approximately 5–8 years and is characterized by an increase in FSH and a decrease in estradiol until they reach stable levels and late menopause in which further changes in reproductive endocrine function are more limited and processes of somatic aging become of paramount concern (Harlow et al. 2012). One of the most significant and alarming aspects during menopausal transition is the weight gain which mainly depends on aging, hormonal imbalance and social and behavioral factors such as reduced physical activity and less adherence to a healthy and balanced diet (Chopra et al. 2019), but also depends on psychological and behavioral factors such as depression, anxiety, mood disorders, irritability and emotional eating; in particular in menopausal women during the period of transition, high prevalence of negative emotional state (depression, stress, anxiety, tension, and mood disorder), sleep disturbances and sexual problems have been reported (Chopra et al. 2019). Regarding the hormonal changes, in particular the drop in estrogens levels can lead to an alteration of the energy homeostasis and of hunger and satiety signals regulated by the central nervous system. Since the estrogens inhibit the sense of hunger acting on the estrogen receptors alpha (ERα) receptors of the pituitary hypothalamus circuit, estrogen deficiency as occurs in menopause causes an increase in the orexigenic signals and an increased caloric intake which is accompanied by a reduction in energy expenditure and physical activity leading to an unfavorable energy balance (Mauvais-Jarvis, Clegg,

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and Hevener 2013). The fundamental role of estrogen on body composition was observed in both animal and human models with surgically induced menopause: oophorectomized rats had increased obesity and food intake, decreased physical activity and energy expenditure while estrogen replacement therapy decreases the oophorectomy-induced weight gain and abdominal adiposity deposition (Karvonen-Gutierrez and Kim 2016). Further studies also showed in women that hysterectomy and the resulting drop in estrogen resulted in a body mass index (BMI) and waist circumference greater than controls with normal ovarian function (Karvonen-Gutierrez and Kim 2016).

Weight gain is also characterized by a change in body composition i.e., lean mass loss and accumulation of fat mass and by a redistribution of the adipose tissue in the abdominal area, typically defined as android distribution: in fact it has been observed that postmenopausal women had greater central adiposity than premenopausal women (Abdulnour et al. 2012; El Khoudary and Thurston 2018; Sowers et al. 2007). Weight gain contributes to the increased prevalence of metabolic syndrome in menopause and the increase in cardiovascular risk: it has been observed that during the menopausal transition, the severity of the metabolic syndrome increases and that this phase seems more associated with the clustering of metabolic syndrome components than worsening of a single component alone (Gurka et al. 2016; Lejskova et al. 2012). Earlier age at menopause, therefore an early hormonal deprivation, has been independently associated with higher risk of cardiovascular diseases, stroke, heart failure and total and ischemic heart disease mortality (El Khoudary and Thurston 2018). Therefore, it is necessary to implement a series of both diagnostic and therapeutic measures aimed on the one hand to promptly identify the subjects most at risk and on the other to prevent and treat the individual risk factors including obesity and its metabolic consequences. As regards the diagnosis, the measurement of paracardial adipose tissue (PAT), which seems to be a specific menopause cardiovascular risk factor, could be promising: in the Study of Women's Health Across the Nation (SWAN) cardiovascular fat ancillary study, it was observed that late perimenopausal and postmenopausal women had 20.7% more PAT and 9.9% more epicardial adipose tissue (EAT) volumes than premenopausal/early premenopausal women, greater PAT, but not EAT volume, was associated with reduced estradiol after adjustment for potential confounder factors and that postmenopausal women with more PAT had greater cardiovascular risk compared with premenopausal ones (El Khoudary et al. 2017; El Khoudary et al. 2015). Among the cardiovascular risk factors, the lipid profile appears to worsen during the menopausal transition, in fact the prospective SWAN study, which assessed lipid profile in relation to years since the final menstrual period (FMP), showed that total cholesterol, low-density lipoprotein cholesterol (LDL-C), and apolipoprotein B demonstrated substantial increases within the 1-year interval before and after the FMP, independently of age, and this pattern was similar across ethnic groups, suggesting the importance of plasma lipid monitoring for cardiovascular prevention in perimenopause (Matthews et al. 2009). The accelerated increases in LDL-C around the FMP would seem to be related to greater likelihood of carotid plaque presence after menopause: a total of 863 natural postmenopausal women with no history of heart attack or stroke have been subjected to carotid ultrasound scans at follow-up year 12 or 13 of the SWAN study and it was observed that greater increases in LDL-C within 1 year of FMP were related to greater likelihood of plaque scores, suggesting the importance of careful monitoring of the lipid profile especially during the menopausal transition, being able to provide useful information on the onset of carotid pathology in post menopause (Matthews et al. 2017).

Regarding the treatment, beyond the drugs widely used for individual conditions that include metabolic syndrome such as lipid-lowering, antidiabetic and antihypertensive agents, the best strategy is the lifestyle intervention in particular by increasing physical activity and follow a healthy and balanced diet, rich in fibers and antioxidant foods, sustainable for life, such as the Mediterranean diet (MD). Of interest, studies reported that one of the single most important lifestyle modifications for the prevention of several chronic diseases is physical activity (Cardinal et al. 2015; Paley and Johnson 2018), recognized as a medical treatment in its own right (Pedersen and Saltin 2015). The regular programs of physical activity will significantly reduce visceral fat, independent of weight loss (Davidson et al. 2009). The reduction of visceral fat are important because it is a marker of dysfunctional adipose tissue (Després et al. 2008). In addition, the visceral fat has a central role in the development of a low-grade systemic inflammation state, associated with metabolic syndrome (Ritchie and Connell 2007). The physical exercise as a medical intervention should be prescribed specifically based on the individual's abilities and needs and in terms of its characteristics, including mode, duration, frequency and intensity (Swisher 2010), according to the American College of Sports Medicine Exercise is Medicine® initiative (Garber et al. 2011). Several studies reported that being more physically active has an important impact on cardio-metabolic risk and metabolic syndrome. In particular, the regular aerobic physical activity can help to reduce body weight, blood pressure, triglycerides and improve lipid disorders, including raising high-density lipoprotein cholesterol (Berra, Rippe, and Manson 2015; Myers, Kokkinos, and Nyelin 2019; Pucci et al. 2017; Sallis et al. 2016). The most important effects of regular aerobic physical activity is its impact on the reduction of insulin resistance (Henriksen 2002; Roberts, Hevener, and Barnard 2013), followed by the beneficial effects on reduction of adipose tissue and consequently on decreased of low-grade systemic inflammation, and epigenetic factors.

The hormonal modifications occurring during menopause predispose to metabolic disorders, which in turn promote the development of several chronic diseases, including osteoporosis, cardiovascular diseases and metabolic syndrome (Savanelli et al. 2017; Stefanska, Bergmann, and Sypniewska 2015). A well-balanced and varied diet is a key component of an overall healthy lifestyle, able to prevent the onset of

several chronic diseases or mitigate their severity (Kimokoti and Millen 2016). An essential source of nutrients and energy for maintain body homeostasis and reduce the risk of several chronic diseases are represented by foods and drinks that women daily consume (Kimokoti and Millen 2016). Several factors influence women's food choices, including food habits, accessibility or availability of foods, income, culture, ethnicity, and education (Lawrence et al. 2009). It is therefore important to understand which is the best nutritional pattern to be followed in menopause.

Diet is a complex interaction of single nutrients, foods and phytonutrients and numerous individual compounds, and its benefits are due to a synergistic and/or accumulative effect of these elements which together confer overall benefit (Tapsell et al. 2016). In this context, in order to promote good nutrition for the menopausal woman, the focus should be on healthy dietary pattern and not on individual nutrients.

Several evidence reported that some dietary patterns, such as Western-style diets with a high consumption of red meats, sugars, saturated fats, and sodium, were associated with development of different chronic disease, in particular type 2 diabetes, cardiovascular diseases, and cancer (Casas et al. 2018; Zinocker and Lindseth 2018). Different dietary approaches, as Dietary Approaches to Stop Hypertension (DASH) diet and the MD have reported important results in terms of decreased risk for chronic diseases (Park et al. 2017).

Nevertheless, the MD has been extensively studied and its benefits in terms of reductions in oxidative stress and inflammation are generally well-accepted (Urpi-Sarda et al. 2012; Viscogliosi et al. 2013). The MD appears to reduce the risk of cardiovascular events (Rees et al. 2013), decrease morbidity and mortality (Sofi et al. 2014), and improve cognitive dysfunction (Valls-Pedret et al. 2015), frequently detected in menopause. Furthermore, we reported how the MD is associated with the severity of different endocrine diseases, including polycystic ovary syndrome (Barrea et al. 2019), perturbations of the somatotropic axis (Muscogiuri, Barrea, Laudisio, et al. 2019), prediabetes (Muscogiuri, Barrea, Di Somma, et al. 2019), and breast cancer (Laudisio et al. 2019). Of interest, several studies have reported the beneficial effects of the MD in reducing body weight in menopause (Papavagelis et al. 2018; Sayon-Orea et al. 2015). In particular in a cross-sectional study on 481 postmenopausal women it was observed that a high adherence to the MD, evaluated by Mediterranean Diet Score (MDS) (Panagiotakos, Pitsavos, and Stefanadis 2006), was negatively associated to BMI, waist circumference and waist-to-height ratio, while another dietary pattern with a high consumption of red meat and potatoes and low consumption of nuts and coffee/tea, was positively associated with the same parameters (Papavagelis et al. 2018). Moreover, another cross-sectional study on 8,954 Spanish perimenopausal–postmenopausal women showed that a high adherence to the MD was associated with lower prevalence and lower odds of being overweight/obese (Sayon-Orea et al. 2015). The greater fiber consumptions of the MD are associated with lower estrogen levels (Herber-Gast and Mishra 2013) and these are also inversely associated to vasomotor menopausal symptoms, including hot flushes and night sweats. These characteristics make the MD a healthy dietary pattern also in menopause (Carruba et al. 2006; Papavagelis et al. 2018; Perez-Rey et al. 2019; Stamatelopoulos et al. 2018; van den Brandt and Schulpen 2017).

Beyond body weight and obesity, there are several evidence that associated diet with vasomotor menopausal symptoms, in particular four RCTs (Dodin et al. 2005; Lewis et al. 2006; Murkies et al. 1995; Pruthi et al. 2012), two prospective cohort studies (Gold et al. 2012; Nagata et al. 2001), one case-control (Schilling et al. 2005), and one surveillance study (Somekawa et al. 2001). According to the RCT a daily diet supplemented with soy flour compared to wheat flour in Australian postmenopausal women, significantly reduced hot flushes (Murkies et al. 1995). Similarly, in a Japanese prospective study it has been reported that both isoflavones content and soy product intake were negatively associated with hot flushes in post-menopausal women (Nagata et al. 2001). However, other studies have not suggested this association (Gold et al. 2012; Somekawa et al. 2001). Of interest, beyond individual foods or nutrients, Herber-Gast GC et al. investigated the relationship between the Mediterranean dietary pattern and risk of vasomotor menopausal symptoms (hot flushes and night sweats) in 6,040 women with a natural menopause followed up at 3 years intervals over 9 years in the Australian Longitudinal Study on Women's Health (Herber-Gast and Mishra 2013). A higher adherence to Mediterranean-style diet was negatively associated with vasomotor menopausal symptoms, thus suggesting the MD as tool to prevent vasomotor menopausal symptoms, including hot flushes and night sweats (Herber-Gast and Mishra 2013).

The nutritional assessment by a nutritionist provides a chance to begin a dialog about clinical nutrition and dietetics, offering specific nutritional advices to improve dietary choices to promote a healthy menopause and reduce the risk of menopause-related chronic diseases. Thus, the aim of this document is to provide nutrition and dietetics guidance to be followed by nutritionists taking care of women in menopause, paying particular attention to the MD.

Menopause and body composition changes

Observational studies investigating weight gain throughout the menopausal transition, reported that weight gain is one of major concern in this female lifespan; it has been reported that menopause is associated to approximately 2 kg of weight gain (Sowers et al. 2007; Sternfeld et al. 2004).

Adipose tissue

In a multicentre longitudinal study Khan UI et al. showed the natural history of progression from a metabolically benign overweight/obese to at-risk overweight/obese phenotype in women participating in the SWAN study, a cohort of women in the menopausal transition (Khan et al. 2014). The authors reported that of 866 a metabolically benign overweight and obese women at baseline, 43% progressed to the "at-risk overweight/obese phenotype" when they entered

menopause during 7-year follow-up (Khan et al. 2014). The increase of visceral adipose tissue began 3 to 4 years before menopause, in the perimenopausal phase, and it is associated with a reduction in estradiol and an increase in FSH (Khan et al. 2014). Of interest, estrogens increase lipolysis and influence adipose tissue lipoprotein lipase activity (Mastorakos et al. 2010).

Muscle mass

When women are approximating to menopause, an accelerated loss of both muscle mass and strength occurs with a reduction of 0.6% to 1% of muscle mass *per* year postmenopause and a 21% reduction in muscle strength between ages 25 and 55, occurring at a rate of 1.5% *per* year (Maltais, Desroches, and Dionne 2009). The physical inactivity, low intake of protein, vitamin D, and calcium, can worsen and accelerate the loss of both muscle and strength mass (Maltais, Desroches, and Dionne 2009).

Bone and mineral metabolism

The estrogen withdrawal at menopause, increases bone remodeling with resulting in an increase in bone resorption, which leads to osteoporosis (Awasthi et al. 2018; Li et al. 2020). Osteoporosis affects millions of subjects and it is an important worldwide public health issue (Cruz-Jentoft et al. 2020; Kanis et al. 2019). In particular, osteoporosis is characterized by an increase in bone fragility and susceptibility to fracture due to a low bone mass and to a microarchitectural deterioration of bone tissue (Camacho et al. 2016). Both pathogenesis and mechanisms involved in osteoporosis are not fully understood but it is known that it is mainly an age-related disease, with a higher prevalence in postmenopausal women (Minkin 2019). Of interest, beyond hormonal and genetic factors bone modeling and remodeling are affected by nutrition (Chen, Hou, and Chen 2019; Rizzoli et al. 2014), and a sedentary lifestyle (Pines 2015). Several evidence showed that in Mediterranean countries there is a low incidence of osteoporosis and this could be explained by diet (Jennings et al. 2018; Julian et al. 2018; Rivas et al. 2013). Nevertheless, the role of the Mediterranean Diet in risk of fractures is not yet clear (Kunutsor et al. 2018; Malmir et al. 2018; Palomeras-Vilches et al. 2019). Nutritional factor and dietary pattern are a modifiable factors in the development and maintenance of bone mass (Kitchin and Morgan 2003). Nevertheless, studies on bone mass have focused on the beneficial effects of vitamin D and calcium (Reid, Bolland, and Grey 2014; Weaver et al. 2016), as well as the controversial role of macronutrients, in particular animal proteins in bone metabolism (Hannan et al. 2000). However, it is known that the beneficial effects of nutrition on bone health go beyond these single vitamin, mineral or nutrients (Calderon-Garcia et al. 2012).

Table 1. Health risk classification according to BMI.

Classification of obesity	BMI category (kg/m^2)	Risk of developing health diseases
Underweight	<18.5	Increased
Normal weight	18.5–24.9	Least
Overweight	25.0–29.9	Increased
Grade I Obesity	30.0–34.9	High
Grade II Obesity	35.0–39.9	Very high
Grade III Obesity	≥40	Extremely high

Clinical evaluation of body composition

Nutritionists should assess the BMI in all menopausal women, as part of their nutrition assessment, thus not only focusing on weight. A diagnosis of obesity is established by determining the patient's BMI using the formula weight in kilograms divided by the square of the height in meters. Table 1 reports the health risk classification according to BMI (Chopra et al. 2019; Consultation 2004; Harlow et al. 2012). Most menopausal women who have a high BMI (i.e., $>25.0\,kg/m^2$) have a higher percentage of body fat (Meeuwsen, Horgan, and Elia 2010). It is important to note that BMI is only a screening tool used to screen population at risk of overweight/obesity that however has several limitations. Conversely, waist circumference and waist-to-hip and waist-to-height ratios may offer a more accurate prediction of cardiovascular risk factors (Lee et al. 2008). BMI is commonly used as a surrogate index for adiposity that is inexpensive and easily measured but its main limitation is that evaluates excess weight rather than excess fat (Okorodudu et al. 2010), without distinguishing fat mass from the lean or bone mass (De Lorenzo et al. 2013). Thus, the additional evaluation of at least another indirect parameter of fat distribution such as waist circumference, is recommended in clinical practice, due to its tight correlation with visceral fat (Bosy-Westphal et al. 2010), the main source of low grade inflammation in obesity (Jensen 2008). To further investigate the body composition, bioelectrical impedance analysis (BIA) (Bohm and Heitmann 2013; Fakhrawi et al. 2009; Manios et al. 2013; Tanaka et al. 2015; Xie et al. 1999) can be a safe, noninvasive, convenient, easy to perform, and inexpensive tool to estimate fat and lean mass (Bohm and Heitmann 2013).

BIA is a commonly used method for estimating body composition assessment in clinical practice in different setting of diseases (Barrea et al. 2019; Barrea et al. 2018; Barrea et al. 2016; Barrea et al. 2017).

The Mediterranean diet and menopause in the clinical practice: total energy intake and macronutrients of particular interest in menopause

According to the results of previous studies on nutrient content of the MD, it provides most of the energy from carbohydrate, close to 30% energy from total fat, and the remaining part is represented by protein, 15%. Fats are mainly represented by monounsaturated fatty acids (MUFA) 19%, followed by saturated fatty acids (SFA) 9% and polyunsaturated fatty acids (PUFA) 5%; and cholesterol is consumed at 300 mg/day (Davis et al. 2015). Table 2 shows the

Table 2. The main nutrient content and total energy intake with which the Mediterranean diet should be developed according to the Italian Guidelines for a healthy diet.

Main component	Unit	Nutritional recommendations
Energy (kcal)	2,000	
Carbohydrates (%)	55%–60% of total energy	The energy density of carbohydrates is 3.75 kcal/g.
Simple carbohydrates (%)	<15% of total energy	To prefer whole grains instead of refined grains, including wheat, brown rice, oats, barley, corn. Limit foods containing added sugars, such as snacks, and sweets. High fiber intake (legumes, fruits, vegetables, and whole grains) to increase satiety
Fiber (g)	25 g/die	
Proteins (%)	15%–16% of total energy	The energy density of protein is 4 kcal/g. To include vegetable protein as legumes, tofu and animal as fish, lean meats, poultry without skin, eggs, and low fat dairy products
Lipids (%)	30% of total energy	The energy density of fat is high (9 kcal/g). To prefer healthy fats including monounsaturated and omega-3, including Mackerel, Salmon, walnuts, sea bass, algae, chia seeds
Cholesterol (mg)	<300	
Calcium (mg)	1,000	It is important to consider not only how much calcium to take, but also the pairing with some foods.Phytate and oxalate are known to interfere with calcium bioavailability by binding strongly, thereby making it insoluble
Vitamin D	600/800 UI	Vitamin D is present in oil-rich fish, sunlight-exposed mushrooms, eggs, and milk. Cod liver oil is a rich natural source of vitamin D (attention to the possible contamination by heavy metals, such as mercury)
Iron (mg)	18	For increase iron absorption, include foods-rich in vitamin C in the same meal as iron-rich foods

main nutrient content and total energy intake with which the MD should be developed according to the reference Intake of nutrients and energy for Italian Population and the Italian Guidelines for a healthy diet (Vitiello et al. 2016).

Estimate the correct energy requirement

In menopausal women, the loss of skeletal muscle and gain of adipose tissue induce an age-related decline in the basal metabolic rate (Lazzer et al. 2010). The resting energy expenditure or basal metabolic rate is defined as the amount of energy (in Kcal) required to maintain biological life functions, as breathing, blood circulation, body temperature regulation, muscle contractile activity, brain function, and cell growth (Razmjou et al. 2018). The resting energy expenditure approximately constitutes 60%–75% of the calorie expenditure and it can vary highly among subjects (McMurray et al. 2014). Therefore, modification in the body composition in menopause, including loss of skeletal muscle and gain of adipose tissue, leads to a decrease in the resting energy expenditure (Dube et al. 2011).

The resting energy expenditure is calculated on basal metabolic rate through specific equations based on body weight, height, age, sex and/or free fat mass and fat mass (Poli et al. 2016). The resting energy expenditure predictive equations in women are reported in Table 3.

Total energy intake

The total energy requirements decreases as age progresses, therefore menopausal women need to restrict the total energy intake and increase physical activity to maintain normal body weight (Brończyk-Puzoń et al. 2015). The portion control and the awareness of what one is eating are very important to keep a healthy diet. According to American Heart Association/American College of Cardiology Guideline for Obesity of 2013, the total energy intake for weight loss must be calculated on estimate daily energy requirement with from 500 to 750 kcal/day energy deficit (Jensen et al. 2014).

Protein

Adequate protein intake is critical for maintenance of muscle mass and strength, for prevention of sarcopenia and for maintenance of healthy bone mass (Arentson-Lantz et al. 2015; Morais, Chevalier, and Gougeon 2006). The current DRI is 0.8 g protein/kg body weight (Trumbo et al. 2002). Of interest, the older adults have greater absorption of protein when it is divided evenly into 3 meals (Mamerow et al. 2014). As opposed to a larger evening meal, it is suggested to divide the protein intake evenly over 3 meals because it has been reported to increase muscle synthesis by 25% ($p < 0.03$) (Mamerow et al. 2014). Regarding the protein sources, it is recommended the high consumption of animal protein alternatives such as legumes and or tofu, although regarding animal protein it is recommended at least 2 servings of fish *per* week and lean cuts of meat (Trumbo et al. 2002).

Carbohydrates

Beyond an important source of energy, carbohydrate-rich foods are a source of dietary fiber, vitamins and minerals. The DRI for carbohydrate is 130 g/daily. The acceptable carbohydrates distribution range to meet total energy intake,

Table 3. Resting energy expenditure predictive equations in women.

Authors	References	Parameters	REE predictive equations
Harris and Benedict	Harris and Benedict (1918)	Weight (kg) Height (cm) Age (years)	Weight (kg) × 9.5634 + height (cm) × 1.8496 − age (years) × 4.6756 + 655.0955
Owen et al.	Owen et al. (1986)	Weight (kg)	Weight (kg) × 7.18 + 795
		Fat-free mass (kg)	19.7 × fat-free mass (kg) + 334
Mifflin et al.	Mifflin et al. (1990)	Weight (kg) Height (cm) Age (years) Sex	9.99 × weight (kg) + 6.25 × height (cm) − 4.92 × age (years) + 166 × sex − 161
		Fat-free mass (kg)	19.7 × fat-free mass (kg) + 413
FAO/WHO	FAO/WHO (1985)	Age (years) Weight (kg)	Age 30 − 60 years: 8.7 × weight (kg) + 829
		Age (years) Weight (kg) Height (cm)	Age 30 − 60 years: 8.7 × weight (kg) − 25 × height (m) + 865
Weijs and Vansant	Weijs and Vansant (2010)	Weight (kg) Height (cm) Age (years)	Weight (kg) × 14.038 + height (cm) × 4.498 − age (years) × 0.977 − 221.631
Bernstein et al.	Bernstein et al. (1983)	Weight (kg) Height (cm) Age (years)	7.48 × weight (kg) − 0.42 × height (cm) − 3 × age (years) + 844
		Fat-free mass (kg) Fat-mass (kg)	19.02 × fat-free mass (kg) + 3.72 × fat mass (kg) − 1.55 × age (years) + 236.7
Schofield	Schofield (1985)	Age (years) Weight (kg)	Age 30 − 60 years: (0.034 × weight (kg) + 3.538) × 239
		Age (years) Weight (kg) Height (cm)	Age 30 − 60 years: (0.034 × weight (kg) + 0.006 × height + 3.53) × 239

dietary fiber intake, and micronutrient needs, is 45% to 65% of daily energy intake (Trumbo et al. 2002). In addition, the recommended amount of dietary fiber should be within 20–30 g daily, but in women with dyslipidaemia or impaired fasting glucose, it is recommended an amount of 50 g/day (10–25 g/day of soluble fiber). Of interest, the Adult Treatment Panel (ATPIII) recommends a daily intake of 5–10 g of soluble fiber as a therapeutic option to reduce LDL-C (Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults 2001), while the American Diabetes Association (ADA) recommends 14 g fiber/1000 kcal in patients with type 2 diabetes (American Diabetes Association 2000). All these targets should be obtained by increasing the consumption of fresh fruits and vegetables and eliminating high glycemic index foods (<75) (Chiu et al. 2011; Huo et al. 2015). For the list of foods with their glycemic index, refer to Table 1 of Foster Powell K et al. In International table of glycemic index and glycemic load values: 2002 (Foster-Powell, Holt, and Brand-Miller 2002).

Determining food frequency

The Mediterranean foods to be included in the plan are: extra virgin olive oil (cold pressed), whole grains, vegetables, fruits, legumes, nuts, moderate consumption of fish and dairy products, and low intake of red meat, eggs and sweets. Beverages and foods with added sugars should be limited, and alcohol (especially red wine) should be moderately consumed during meals (no more than one drink *per* day for women (up to 20 g alcohol/day). Table 4 shows each food of the MD and an indication of the frequency based on which these Mediterranean foods should be consumed, according to the MD Foundation (Bach-Faig et al. 2011).

Table 4. Dietary recommendations of Mediterranean diet according to Mediterranean Diet Foundation.

Food	Frequency
Extra virgin olive oil	Every meal
Vegetables	≥2 serves every meal
Fruits	1–2 serves every meal
Breads and cereals	1–2 serves every meal
Legumes	≥2 serves every weekly
Nuts	1–2 serves daily
Fish/Seafood	≥2 serves weekly
Eggs	2–4 serves weekly
Poultry	2 serves weekly
Red meat	<2 serves/week
Dairy foods	2 serves daily
Sweet	<2 serves/week
Red wine	In moderation

Planning of menu

Planning a menu consisting of three main meals (breakfast, lunch and dinner) and two snacks (mid-morning and mid-afternoon), as opposed to 2–3 main meals. The meals should be limited portion size, balanced meals, healthy snacking, and control over emotional eating episodes (Smethers and Rolls 2018).

Dietary salt

Evidence report that dietary salt is a contributor to the risk of hypertension and can contribute to cardiovascular diseases (He et al. 2013). A recent Cochrane meta-analysis concluded than a reduction to 3 g/day of salt intake can reduce blood pressure (He et al. 2013). Nutritionists should advise women to reduce salt intake and reduce consumption of processed foods rich in salt. The limit consumption of table salt intake should be to 5 g *per* day (Brończyk-Puzoń et al. 2015).

Particular attention should be paid to particular dietary rules:

- It is recommended to drink at least 2 liters of water *per* day.
- Foods rich in calcium, including milk products, seeds and nuts, spices, legumes, and green leafy vegetables for the prevention of osteoporosis (Muscogiuri, Barrea, Altieri, et al. 2019; Savanelli et al. 2017),
- The intake of red meat and foods high in phytates for its hinders calcium absorption and should be avoided, while should be preferred lean meat and eggs.
- Attention should be paid to the consumption of foods rich in mineral salts, in particular magnesium (contained in green leafy vegetables, legumes, and nuts and seeds) for relieving hot flushes, insomnia, palpitations, and irritability.
- Food rich in vitamin D, as postmenopausal women are vulnerable to vitamin D deficiency; the supplementation should be provided (Savastano et al. 2017).
- The data are conflicting on the effectiveness of the high soy products consumption for relieving menopausal symptoms (Bolanos, Del Castillo, and Francia 2010)

Conclusion

The weight gain and obesity and consequently several obesity-related diseases, including cardiovascular and metabolic events, are common in menopausal women. Both body weight and menopausal symptoms are influenced by several different factors, such as diet. Several scientific evidence published to date show that diet plays a primary role in the prevention of obesity and weight gain. Considering that, there are no specific dietary guidelines that are directly related to menopause, it should be encouraged women to follow well-known, general healthy dietary recommendations.

Therefore, adequate nutritional management should be mandatory in the clinical practice, and it should involve a tailored diet based on the patient's habits. The MD could be a promising nutritional pattern to be followed in menopause due to its healthy properties. Finally, this manuscript provides a practical guidelines that could be useful for the management of obesity in menopause.

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Abbreviations

ADA	American Diabetes Association
ATPIII	The Adult Treatment Panel
BMI	body mass index
DASH	Dietary Approaches to Stop Hypertension
FSH	follicle-stimulating hormone
LH	luteinizing hormone
MD	Mediterranean diet
MUFA	monounsaturated fatty acids
PAT	paracardial adipose tissue
PUFA	polyunsaturated fatty acids
SFA	saturated fatty acids
SWAN	Study of Women's Health Across the Nation

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