

Position of the American Dietetic Association and Dietitians of Canada: Nutrition and Women's Health

ABSTRACT

It is the position of the American Dietetic Association (ADA) and Dietitians of Canada (DC) that women have specific nutritional needs and vulnerabilities and, as such, are at unique risk for various nutrition-related diseases and conditions. Therefore, the ADA and the DC strongly support research, health promotion activities, health services, and advocacy efforts that will enable women to adopt desirable nutrition practices for optimal health. Women are at risk for numerous chronic diseases and conditions that affect the duration and quality of their lives. Although women's health-related issues are multifaceted, nutrition has been shown to influence significantly the risk of chronic disease and to assist in maintaining optimal health status. Dietetics professionals strongly support research, health promotion activities, health services, and advocacy efforts that will enable women to adopt desirable nutrition practices for optimal health.

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POSITION STATEMENT

It is the position of the American Dietetic Association (ADA) and Dietitians of Canada (DC) that women have specific nutritional needs and vulnerabilities and, as such, are at unique risk for various nutrition-related diseases and conditions. Therefore, ADA and DC strongly support research, health promotion activities, health services, and advocacy efforts that will enable women to adopt desirable nutrition practices for optimal health.

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Women account for approximately half of the population in the United States (1) and Canada (2). Early definitions of women's health were limited to reproductive health (3). However, more recent definitions consider the diverse issues that affect women today (4) and the complex interactions among women's physical, mental, social, and emotional health (5,6). Women's health-related behaviors are influenced by many factors. In particular, gender-based health determinants such as culture and traditions, ethnicity, education, socioeconomic status, working conditions, and coping skills need to be factored into health care policies and practices that are specifically designed for women (6-8). The population of women in the United States and Canada currently numbers over 150 million, a population that is exceptionally diverse in terms of both age distribution and ethnic and/or racial status. Thirty-three percent to 40% of North American women are of reproductive age, 50% to 54% are between the ages of 45 and 64 years, and 14% to 20% are age 65 years or older (1,9). In the United States, approximately 40 million women belong to racial or ethnic minority groups (1); 13% of the total population are African American, 11% are Hispanic, 4% are Asian American/Pacific Islander, and almost 1% are American Indian/Alaska Native women (9). In Canada, 2.5 million women belong to a racial or ethnic minority group; 8% are of Asian origin, more than 3% belong to the Aboriginal population, and 2% are black (2). Disparities in health exist in the United States as well as in Canada for minority women based on disparities in socioeconomic status and access to medical care and health resources, as well as geographic location, social, and cultural issues (10,11). Barriers to health care services may influence morbidity and

mortality from chronic diseases such as cancer, cardiovascular disease (CVD), diabetes mellitus, obesity, and osteoporosis. In light of this, the Office of Research on Women's Health (ORWH) (12) has recently developed a focused research plan to identify and address gaps in women's health related to ethnicity and racial disparity (13). Centers of Excellence for Women's Health exist in both the United States (14) and Canada (15) that purport a multidisciplinary research agenda on women's health issues and an integrated model for the delivery of clinical health care services to women and provide coordination between clinical services in academic centers and surrounding communities.

Women are at risk for numerous chronic diseases and conditions that affect the duration and quality of their lives. Dietetics professionals can enhance women's health by helping women recognize the means of maintaining healthful eating habits and health-promoting practices. Dietitians also can advocate for public policy, legislation, and financial allocation to optimize the nutritional status of women and allow for continued gender-specific research in this area (13).

CURRENT FOOD INTAKE, NUTRITION, AND LIFESTYLE FACTORS

A high proportion of young United States women (20 to 50 years of age) are under consuming a variety of nutrients as seen in the latest results of the Third National Health Examination Survey (16). Irrespective of ethnic origin, 75% of women do not meet current Adequate Intakes for calcium, and 90% of women have inadequate intakes of folate and vitamin E from food sources alone. Overall, United States women are not meeting their nutritional needs through their typical diets (16). In Canada, a major-

ity of women (57%) do not meet the recommended requirement of five or more servings of fruits and vegetables a day (17). Although in both countries the percentage of energy from fat has decreased over time, there has been an increased consumption of the total amount of fat, total energy, and refined carbohydrates (18). These patterns of intake are associated with the increased prevalence of obesity (19) and insulin insensitivity, as well as growth factors that may promote the development of cancer (20). Chronic over consumption of foods high in energy and low in nutrients may result in marginal nutrient intakes if substituted for nutrient dense foods or in obesity, if consumed in addition to the basal diet (21). In the United States, more than 31% of daily energy is composed of foods that are energy dense and nutrient poor (22). This pattern of eating may contribute to excessive intakes of sugar, salt, and fat (22).

Women's increased total paid and unpaid employment may have negatively influenced their dietary practices (23). Seventy percent of women in the United States and Canada are employed (2). Although time for food prepared at home has significantly decreased (24), women are still cooking meals more than twice as frequently as men (25). Meals eaten outside of the home account for 27% of all foods consumed, which represents a two-third increase over the last 2 decades (26). Frequent dining at fast-food establishments may not be conducive to a healthy weight; such meals contain more energy, fat, cholesterol, and sodium while providing reduced amounts of fiber and vitamins (27). Although healthier foods are becoming more readily available, they are not always chosen. Moreover, the portion size of foods sold has increased in recent years, especially at fast-food restaurants (28-30). Portion sizes of snack foods and beverages consumed within the home also have increased, leading to excess energy intakes (31). Although women's diets may contain excess energy, studies show marginal intakes of calcium, iron, vitamin D, and folic acid. For example, in the Nurse's Health Study, data indicate that women who consume more than 12.5 μg of vitamin D daily from foods and supplements had a 37% lower risk of hip

fracture, yet only 41% of women met these levels (32). The prevalence of vitamin D deficiency is 42% among African-American women of childbearing age and 4.2% among whites, based on serum 25(OH) D concentrations (33,34).

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The generalized lack of folic acid in women's diets, as well as the link between its deficiency and neural tube defects (NTD) (35), have prompted a major fortification program of flour and other cereal products in both the United States and Canada (36,37). A recent study conducted among 336,963 women who underwent maternal serum screening for folic acid showed a relative decline of 58% in spina bifida and a 43% reduction in anencephaly (38).

Although food sources of nutrients should be encouraged, diet alone may not be sufficient to achieve nutritional adequacy during all times in a woman's life. Currently, 64% of United States women of childbearing age report taking some form of vitamin supplement, with cost considered to be the major barrier to nonuse (39). In Canada, 42% of women report supplement use, which contributes to higher overall intakes of thiamin; riboflavin; niacin; folate; and vitamins B-6, B-12, C, and D. Among women of childbearing ages using multivitamins, 80% attain RDA level intakes compared with only 19% of nonusers. According to Troppmann and colleagues (40), multivitamin supplements help overcome low intakes of folate, iron, and vitamin D, and calcium supplements were effective in achieving adequate calcium intakes. However, a conundrum exists in that individuals who are the most likely to use supple-

ments are also those who consume better diets, whereas those who consume poorer diets and are most likely to benefit from supplements are less likely to use them (16). Readers are referred to the ADA Position on Nutrition and Lifestyle for a Healthy Pregnancy Outcome (41), the Nutrition for a Healthy Pregnancy, National Guidelines for the Childbearing Years (42), and Preconception Health-Folic Acid for the Primary Prevention of Neural Tube Defects (43) for a more complete review of folic acid supplementation during pregnancy.

Sedentary lifestyles and reduced physical activity adversely influence weight status (44,45). Women who work long unpaid hours at home after their occupational employment may have little time or energy for exercise (46). The majority of North American women (36% non-Hispanic White, 55% African American, and 57% Hispanic White) report no leisure time physical activity. Similarly, most Canadian women (59%) are sedentary with inactivity increasing with age (47). To promote physical activity in women, fitness programs should be enjoyable and convenient to a woman's daily life (48).

Cigarette smoking often is perceived as a means to control weight (49) and is associated with poorer diets for many young women (16). Cigarette smoking is a strong risk factor for several major chronic diseases, including lung cancer, hypertension, osteoporosis, heart disease, and cerebrovascular accidents (50,51). Smoking cessation should be a priority for improving women's health and nutrition (52). Currently, 22% of women in the United States (50) and 20% in Canada (2) smoke cigarettes; among high school girls, the prevalence is even higher (27.7%). Recent research in Canada suggests that there has been a 24% decrease in the percentage of women smokers between 1994 and 2000 (2); unfortunately, the United States cannot boast the same success (50).

In summary, changes in employment and total workload may negatively affect women's energy balance and nutritional adequacy. Working conditions, socioeconomic status, availability of health care and other determinants of health are seldom taken into consideration in nutrition

surveys but need to be considered when developing programs for high-risk groups. The overall quality of women's diets is likely to improve by replacing nutrient-poor foods with foods rich in nutrients and lower in energy (16). Means of simplifying preparation of healthy food at home needs to be encouraged, along with establishing appropriate portion control. Current lifestyle habits should include opportunities for increased physical activity and the incorporation of enjoyable fitness programs into a women's daily life (48). Efforts toward smoking cessation also should be supported.

OPTIMAL FOOD INTAKE, NUTRITION, AND LIFESTYLE FACTORS

Although an optimal diet is thought to contribute to improved health and well-being, to date, there are no data from randomized controlled trials that verify the combined effects of multiple dietary recommendations on the overall health and chronic disease risk in women. However, results from epidemiologic investigations suggest that diets composed primarily of fruits, vegetables, whole grains, low-fat dairy, and lean meats are associated with a lower risk of mortality in women (53,54). This nutritional pattern serves as the basis for many of the guidelines promoted by the major disease-related organizations, such as the American Heart Association, Canadian Heart and Stroke Foundation, American Diabetes Association, Canadian Diabetes Association, and American and Canadian Cancer Societies. Another framework is provided by the Alternate Healthy Eating Index (AHEI), which further identifies more specific food choices, such as increased fruit and vegetable intake, soy or nuts on a daily basis, a ratio of fish and poultry to red meat of 4-to-1, and more cereal fiber. A study by McCullough and colleagues (55) suggests that this eating pattern is associated with an 11% lower risk of major chronic disease and a 28% reduction in risk of CVD in women.

Eating healthful foods in individual portion sizes defined by the United States Department of Agriculture Handbook Number 8 (56) can assist in the maintenance of a healthy weight. Importantly, physical activity also is part of a healthy lifestyle and

has been shown to assist in weight management and decrease visceral adipose tissue, which are important risk factors for diabetes mellitus, CVD, and certain cancers (57). Recently, the Institute of Medicine released guidelines for physical activity, which include 1 hour of exercise per day. Likewise, Canada's Physical Activity Guide to Healthy Active Living (58) supports an identical recommendation. Physical activity is cumulative and includes daily activities, plus moderate to vigorous exercise, such as walking at a rate of 4 miles per hour (58). Nutrition education efforts should underscore the need for healthful food choices, portion control, and regular physical activity to promote overall health.

RECOMMENDATIONS FOR COMMONLY OCCURRING CONDITIONS

Overweight and Obesity

Overweight and obesity are the leading nutritional concerns in both the United States and Canada (7,22,59). Obesity is more prevalent among women than men, 27% vs 21%, respectively (59). Among United States women, ages 20 to 74 years, 62% are overweight, and 34% are obese (60). Furthermore, non-Hispanic black women have the highest prevalence of obesity and overweight; more than half of African-American women are obese, and approximately 80% are overweight (61). Moreover, more women than men are trying to lose weight, even those who are within an acceptable weight range.

Overweight and obesity are associated with heart disease and cerebrovascular accidents (62); type 2 diabetes mellitus (63); and cancers of the gallbladder, breast (postmenopausal), endometrium, and colon (64). In addition, gallstones or gallbladder disease, osteoarthritis, gout, sleep apnea, hypertension, hyperlipidemia, pregnancy complications, and irregular menses are more common in overweight individuals (65). A healthy body weight for a woman, who is not pregnant or lactating, or who is not highly muscular, is based on the standard of body mass index (BMI) of 18.5 to 25 (65,66). Please refer to the Expert Panel of the National Lung and Blood Institute's clinical guidelines for the identification, evaluation, and treatment of overweight and obesity

in adults; The Evidence Report (1998) for weight classification scheme (65); and Health Canada (66) for details of reference standards.

Obesity may affect a woman's psychosocial status and functioning. Early onset of obesity in women is associated with body dissatisfaction and impaired self-esteem (67). Consequently, many overweight and obese women may engage in dieting throughout their lives and may experience periods of weight cycling. Weight cycling has been associated with binge eating and a perception of a poor health status (68). Among normal weight, female college students, frequent dieting (69) and rigid dieting (70) have been shown to be associated with eating disorders symptoms, body dissatisfaction (69), and preoccupation with body weight and shape (70). However, longitudinal studies are required to ascertain whether chronic dieting is a risk factor for eating disorders.

In summary, obesity is associated with several chronic diseases and comorbid conditions, such as several cancers (20), coronary heart disease (62), diabetes mellitus (63), and the metabolic syndrome (71). Weight loss and increased physical activity can help reduce the likelihood of these diseases and conditions. The best proven method of achieving and maintaining weight loss is through long-term changes in lifestyle, such as healthful dietary habits and the inclusion of regular physical activity (72). Dietetics professionals should encourage women to balance healthful eating with regular physical activity (52).

Eating Disorders

Women are at increased risk for the development of eating disorders. Eating disorders are complex, psychiatric illnesses that are characterized by atypical eating behaviors, disturbed body image and preoccupation with body weight and shape, and food intake (73). Eating disorders, both clinical and subclinical, affect approximately 5 to 10 million females in the United States (73). Of particular concern is that 85% of eating disorders occur when girls are still growing, ie, at the onset of adolescence (74). Moreover, early adolescent anorexia nervosa and bulimia nervosa may in-

crease the risk for eating disorders during young adulthood (75).

Young adult women who have eating disorders face an increased likelihood of complications during normal life events such as pregnancy. Eating disorders during pregnancy have been associated with a higher frequency of Cesarean section and greater postpartum depression (76) as well as higher rates of miscarriage, obstetric complications, and lower birth weight than women who did not show symptoms of eating disorders during pregnancy (77).

A significant number of women who are at risk for eating disorders include athletes who seek to improve performance. Consequences of eating disorders in athletes include the Female Athlete Triad, which is composed of disordered eating, amenorrhea, and premature osteoporosis (78). Other disturbances may include fatigue; anemia; electrolyte imbalance; decrease in strength, endurance, reaction time and/or speed; and an inability to concentrate (79).

Eating disorders may persist throughout a woman's life, which may increase both physical and psychosocial morbidity (80). Primary prevention is the best approach to help reduce the prevalence of eating disorders. This includes educating preadolescent girls on the importance of accepting their body and promoting healthy self-esteem (81). Prevention efforts also include screening those who exhibit risk factors or mild symptomatology (82). As a member of the interdisciplinary eating disorders health care team, registered dietitians should seek specialized training beyond the minimum competencies to treat effectively those with eating pathology (83). To promote healthy self-esteem and normalize eating habits, dietitians should partner with women to include goals in their weight counseling strategies that support body size acceptance and the attainment of a healthful weight (84).

Anemia

In North America, 3% to 5% of young women (18 to 44 years of age) have clinically manifest iron-deficiency anemia, while subclinical iron deficiency ranges between 11% to 13% (85). Iron deficiency decreases energy and endurance and reduces work ef-

iciency and can induce preterm delivery as well as result in low birth weight (86). Women report fatigue three times as frequently as men, and this fatigue can be linked to low ferritin levels (87). Indicators of low iron status are seen more often among Mexican-American women of child-bearing age as compared with non-Hispanic whites (6.2% vs 2.3%) despite similar dietary iron and vitamin C intakes, use of supplements, and contraceptive use (21). Limited access to screening and treatment, plus factors related to income are all cited as possible causes (88). Women with unexplained fatigue and ferritin levels below 50 $\mu\text{g/L}$ may benefit from iron supplementation (87). Importantly, dietetics professionals should provide young women with guidance on how to increase the consumption of iron-rich foods, as well as methods to enhance absorption (ie, simultaneous consumption of vitamin C-rich foods).

Premenstrual Syndrome

Up to 40% of women of childbearing age experience sufficient Premenstrual Syndrome (PMS) symptoms to affect their daily lives, and 3% to 8% experience severe impairment now called Premenstrual Dysphoric Disorder (PMDD) (89,90). New evidence suggests that PMS may be associated with fluctuations in calcium homeostasis and parathyroid hormone dysregulation. Calcium supplementation (1,000 to 1,300 mg/day) has been tested in a few clinical trials and has been shown to alleviate the majority of symptoms including irritability and cramping (91,92). A systematic review on the efficacy of vitamin B-6 in the treatment of PMS suggests that doses up to 100 mg/day can be of benefit in alleviating premenstrual symptoms and premenstrual depression (93). In contrast, consistent findings have not been observed with supplemental multivitamins, magnesium, manganese, or gamma linolenic acid (94) nor reductions in alcohol, sodium, or caffeine. PMS and PMDD affect a significant number of women who may seek nutritional advice. A thorough dietary assessment may provide a basis for nutritional guidance that includes better food choices and adequate supplementation when required.

Polycystic Ovary Syndrome

Polycystic Ovary Syndrome (PCOS) is a common endocrine disorder that affects 4% to 10% of women of reproductive age (95,96). PCOS falls under the umbrella of Syndrome X disorders and is characterized by insulin resistance, hyperandrogenism, and chronic anovulation (95-97). The syndrome generally manifests itself at the time of puberty, with clinical symptoms of hirsutism, amenorrhea, and obesity. If left untreated, women with PCOS are likely to encounter significant reproductive morbidity, as well as be at increased risk for type 2 diabetes; CVD; and cancers of the breast, endometrium, and ovary (96,97). Weight loss, via decreased energy intake and increased caloric expenditure (exercise), is a first line treatment for PCOS, with modest losses in weight of 5%, frequently resulting in improved biochemical profiles (ie, decreased levels of insulin and androgens [both free and total]) as well as clinical symptoms (ie, hirsutism and infertility) (98). Studies are currently being conducted to determine the additional benefit of low glycemic index diets that incorporate increased amounts of dietary fiber (95,97).

Infertility

Infertility affects six million couples in the United States, or 10% of the population of reproductive age. Disturbed endometrial function, menstrual disturbance, and anovulation are all etiologic factors for infertility (99). In a retrospective study conducted among women (n=3,586) receiving assisted reproductive treatment, a body mass index (BMI) that was either very high (>35) or low (<20) was associated with the reduced probability of achieving pregnancy (99). Pernicious anemia also has been associated with infertility. Low levels of vitamin B-12 and folate have been noted in infertile women or women with repeated miscarriages; nutrient supplementation has yielded positive results in a small group of women, but further research must be pursued (100). Achieving or maintaining a healthful weight along with an adequate dietary intake is recommended for women who want to conceive.

Pregnancy and Lactation

Nutrition plays a major role in pregnancy and lactation. Women's diets and eating habits may significantly affect the outcome of critical periods of increased body demands for nutrients. Readers are referred to the ADA Position on Nutrition and Lifestyle for a Healthy Pregnancy Outcome, 2002 (41) and Nutrition for a Healthy Pregnancy, National Guidelines for the Childbearing Years (42) for complete reviews.

Menopause

Nearly 24 million North American women are in their menopausal years. The vast majority of women gain weight during these years (101,102). However, the Women's Healthy Lifestyle Project has shown that a lifestyle intervention using a low-fat, low-calorie diet plus regular exercise during perimenopause may abrogate weight gain (103). Menopause also is associated with bone losses of 3% to 5% per year during the transition years, as discussed further in the section on osteoporosis. Among other symptoms, 15% of women complain of severe hot flashes (104). To alleviate menopausal symptoms, an estimated one-third of American and Canadian women were using hormone replacement therapy (HRT) (105). However, these statistics were collected prior to the release of the results of the Women's Health Initiative, which showed an increased risk: benefit ratio (106). The Study of Women's Health across the Nation (SWAN), a longitudinal study of over 3,300 women of varied ethnic backgrounds aged 40 to 55 years (107), will enable a better understanding of how diet and health is related during menopause (108). Initial data from food frequency questionnaires reveal significant differences by ethnicity for several nutrients (ie, energy intakes are greater among African-American women, fat intakes are lowest in Chinese and Japanese women, calcium intakes are higher among white women, and fiber intake from beans are almost four times higher among Hispanic women). Phytoestrogen intakes also are significantly higher among Chinese and Japanese women who also report the fewest vasomotor, psychologic, and psychosomatic symptoms compared with the

three other ethnic groups. Forthcoming analysis will relate nutrient intakes to a range of health outcomes at menopause (108). Meanwhile, clinical trials conducted in several countries have used soy in the form of food or isoflavone extracts to relieve menopausal symptoms. Isoflavone extracts taken at doses of 70 to 100 mg/day show a 40% to 60% reduction of hot flashes compared with a 20% improvement with the placebo (109); lower doses of isoflavones do not provide the same benefits (110). Other popular supplements used to reduce menopausal symptoms include flaxseed (111,112), ginkgo biloba, and black cohosh (113). A randomized controlled trial of ginkgo biloba (40 mg three times a day) showed no memory improvement after 6 weeks (114). Although there are new regulations on Natural Health Products in Canada (115), the potential benefits, hazards, and interactions of supplements with food and/or medicines remains uncertain (116). Therefore, at present, nutrition interventions should focus on limiting weight gain as well as improving the quality of the diet. This may be helpful in enhancing overall health and well-being.

Postmenopause and Old Age

Older women are more likely to be at increased nutritional risk than men because of limited dietary intake (117). Low fruit and vegetable intake, food avoidance, and cooking and chewing difficulties are among the key indicators of nutritional risk (118). Preventing sarcopenia, as well as minimizing bone loss, can improve the health of postmenopausal women. Regular physical activity and resistance training can attenuate lean tissue loss with age (119). A cardioprotective diet is recommended for the prevention of CVD. Suboptimal intakes of calcium and zinc are observed among approximately 87% and 40% of women, respectively (120). Elderly women may be at increased risk for inadequate intake of micronutrients because of lower energy intake (121). Nutrient supplementation may become important (121), but guidance on appropriate supplement usage is needed (122).

Disease Prevention

North American women are at unique risk for certain major nutrition-related diseases and conditions, including diabetes mellitus (123), CVD (124), several cancers (125), and osteoporosis (126). Over the past 4 decades, obesity has increased among women of all races and ages (127). For promoting optimal health and reducing the risk of chronic disease, women should be encouraged to achieve and maintain a healthful body weight, to choose wisely a wide variety of foods, and to follow other prevention strategies as outlined in Figure 1.

COMMON CHRONIC DISEASES AMONG WOMEN

Diabetes Mellitus

Diabetes mellitus affects an estimated 16 million Americans (123) and more than 2.25 million Canadians (128). Approximately 8.9% of women in the United States have diabetes mellitus (123). The incidence and mortality data for diabetes mellitus vary among women according to race and ethnicity. Diabetes mellitus is the fourth leading cause of death in African-American, Native American, and Hispanic women; the sixth leading cause in Asian-American women; and the seventh cause in white women (123). Furthermore, women who are African American, Hispanic American, Native American, Asian American, and Pacific Islander are at increased risk for type 2 diabetes mellitus (129). In Canada, women who are single or from low-income groups have a greater prevalence of diabetes mellitus compared with women who are married or from higher income groups (130). The Expert Committee on the Diagnosis and Classification of Diabetes (131) and Canadian Clinical Practice Guidelines on Diabetes (132) provide an in-depth review of the classification, diagnosis, and etiology of this disease.

The increased prevalence of diabetes mellitus in North America is positively associated with the increased prevalence of obesity (133). Of particular concern is the increasing prevalence of obesity in women of childbearing age because this is associated with gestational diabetes mellitus (GDM). The prevalence of GDM increases when women have an in-

Factors affecting energy and/or nutritional status	Cancer								
	Cardiovascular disease	Diabetes mellitus	Breast	Lung	Colon/rectum	Endometrium	Cervix	Ovary	Osteoporosis
Avoidance of obesity	++ ^a	++	++ (postmenopausal) - ^b (premenopausal)	? ^c	++	++	0 ^d	?	-
Physical activity	++	++	++	?	++	+ ^e	?	?	++
Dietary fat									
Total	?	-- ^f (>30%)	?	?	?	?	?	-	?
Saturates	--	--	?	?	-	?	?	-	?
Monounsaturates	+	+	?	?	?	?	?	?	?
Polyunsaturates	+	+	?	?	?	?	?	?	?
Trans fatty acids	-	-	?	?	-	?	?	?	?
n-3's	+	+	?	?	?	?	?	?	?
Meat/protein	Preferred protein sources are either plant-based or lean meats, fish, poultry, and low-fat dairy		?	?	-- for processed & red meats	?	?	?	?
Fruits and vegetables	++	++	+	++	+	?	+	+	?
Refined carbohydrate	?	-	?	?	-	?	?	?	?
Dietary fiber	++	+	?	?	+	?	?	?	?
Minerals	Sodium (-) Calcium (+) Magnesium (+) Potassium (+)	Chromium (?) Vanadium salts (-) Folate (+) prevent birth defects Calcium (+) older persons			Calcium (+) Selenium (?)				Calcium (++) Phosphorus (?) Magnesium (+)
Vitamins	Folate (++) B-6 (+) B-12 (+)	Antioxidant supplements (-)			Folate (++)				D (++) K (+)
Alcohol	+	?/- (hypoglycemia or hyperglycemia)	--	?	-	?	?	?	-
Caffeine	?	?	0	?	?	?	?	?	?
Other		Herbal preparations (-)	Breastfeeding (++) Soy (?)					Galactose (?) Isoflavones (?)	

^a++=Convincing evidence of benefit as supported by systematic reviews and/or meta-analyses.
^b--=Probable/possible evidence of harm (studies showing associations are either not so consistent or the number or type of studies is not extensive enough to make a definitive judgment).
^c?=Insufficient evidence to conclude benefit or risk.
^d0=No association.
^e+ =Probable/possible evidence of benefit (studies showing associations are either not so consistent or the number or type of studies is not extensive enough to make a definitive judgment).
^f--=Convincing evidence of harm as supported by systematic reviews and/or meta-analyses.

Figure 1. Associations between nutritional factors and prevalent diet-related diseases among North American women.

creased BMI and increased gestational weight gain before 28 weeks of gestation (134). Hispanic and African-American women are at increased risk for GDM (134). Using the Carpenter and Coustan cutoffs (135), it has been found that GDM complicates approximately 4.8% of all pregnancies in the United States (136) and 2% to 4% of those among Canadian women (128).

Recent prospective epidemiologic studies point to an association between diets with a high glycemic index and a greater risk of type 2 diabetes mellitus in women (137), a finding associated with increased insulin resistance. Increased intake of whole grains and a

diet with a low glycemic index may reduce the risk of diabetes mellitus and CVD because of enhancement of insulin sensitivity and an improvement in blood lipid concentrations, respectively (138,139). Although these findings appear promising, more prospective long-term research is required before recommendations based on consensus can be made to prevent diabetes mellitus. The role of the glycemic index in diabetes mellitus medical nutrition therapy remains controversial. Current data do not provide convincing evidence of benefits from low vs high glycemic index diets in persons with the disease (140,141). According to the American Diabetes Association (140), there is not

sufficient long-term benefit to recommend low glycemic diets as a strategy in meal planning. However, the Canadian Diabetes Association's nutrition guidelines recommend the inclusion of low glycemic index foods to optimize control of blood glucose concentrations, especially in persons with type 2 diabetes mellitus (132). Future research is needed among subjects who consume mixed meals. Glycemic and insulin profiles should be studied daylong to assess the beneficial effects of higher fiber, reduced fat, and low glycemic foods, especially when consumed in combination with other foods (141). Readers are referred to the American Diabetes Association's nutrition prac-

tice guidelines for the use of alcohol among persons with diabetes (140).

Women with diabetes mellitus, especially those who are overweight, are predisposed to CVD and hypertension (142). It is well established that physical inactivity contributes to overweight and obesity (143). Approximately 31% of adults with type 2 diabetes mellitus report no regular physical activity, and another 38% report less physical activity than recommended levels (144). Structured weight-loss programs that emphasize lifestyle changes that include reduced fat (<30% of daily energy) and energy intake, regular physical activity, and regular participant contact can help promote long-term weight loss of 5% to 7% of starting weight in persons with diabetes mellitus (140).

The long-term complications of diabetes mellitus are exacerbated by excess weight (145). Longitudinal research clearly indicates that tight metabolic control is associated with a reduced risk of long-term microvascular complications of diabetes mellitus (146). Furthermore, long-term studies indicate that a sustained moderate weight loss in persons who are obese may assist in the improvement of metabolic control as a result of decreased insulin resistance (147).

Over the past decade, research has documented the coexistence of eating disorders among individuals with diabetes mellitus (148). Women with diabetes mellitus may be at risk for eating disorders because of their focus on diet and the need for control of intake as related to blood glucose concentrations. The prevalence of eating disorders among female adolescents and young adult women with diabetes mellitus is twofold that of females of similar age without diabetes mellitus (149). Intentional insulin misuse or omission for the purpose of weight control may indicate an eating disorder in women with type 1 diabetes mellitus. Both insulin misuse and full or partial syndrome eating disorders (150) are associated with poor metabolic control of diabetes mellitus, as well as long-term complications, especially in type 1 diabetes mellitus (149). Of central concern is the increased risk for mortality in this population (151).

In conclusion, medical nutrition therapy (MNT) is essential to diabetes mellitus management of women.

This includes attention to diet, increase in physical activity, self-monitoring of blood glucose concentrations, and metabolic parameters (140). Recommendations include consumption of a variety of foods with particular attention to macronutrient distribution (131,132,140). For women with type 2 diabetes mellitus who are overweight, lifestyle changes include reduced energy intake, increased physical activity, and nutrition education with the goal of promoting weight loss (152). As educators, dietetics professionals significantly contribute to the management of persons with diabetes mellitus (153).

Cardiovascular Disease

CVD is the leading cause of death among women over age 70 years. In the United States, heart disease represents 42.5% of all deaths in females, whereas, in Canada, it represents 37% (154,155). Of all CVD, 54% are due to coronary heart disease (CHD), 20% to cerebrovascular accidents, 16% to other forms of heart disease, and the remaining 10% to vascular problems such as high blood pressure and atherosclerosis. Under the age of 75 years, more men have CHD and more women have congestive heart failure (CHF). The incidence of CHD in women lags behind men by 10 years for total events and by 20 years for more serious clinical events such as myocardial infarction and sudden death (154).

Hypertension affects 52% of women over 45 years of age and is another risk factor for CVD.

Hormone replacement therapy (HRT) is no longer considered a heart-healthy measure (156) and may even serve as a risk factor (157-160). Despite improvement in lipid profiles, HRT is associated with an increased risk of CHD among healthy women (161,162), as well as among women with heart conditions (163,164). Following the results of the Women's Health Initiative trial, the North American Menopause Society (165) advisory panel as well as the Society

of Obstetricians and Gynecologists of Canada (166) concluded that HRT should not be used for primary or secondary prevention of coronary heart disease.

To prevent CVD, the type of dietary fat has become more important than the total amount of fat. Based on a large body of evidence, the optimal diet to reduce risk of CVD contains less saturated fat and a minimum amount of *trans*-fatty acids from processed foods (167). Long-chain n-3 fatty acids, from fish and certain nuts and seeds, are to be encouraged because of their favorable effect on serum triglycerides, platelet aggregability, and endothelium functions and their antiarrhythmic effects (168). Prospective studies that have explored n-3 fatty acids and their effect on cardiovascular risk in women suggest that a high intake of fish is associated with a reduced risk of total stroke or thrombotic stroke (169) and a reduction of sudden cardiac death. In a large randomized controlled trial, n-3 supplements showed a 45% reduction in sudden death among patients surviving a recent MI (170). The 50% to 70% decrease in cardiac mortality seen in the Lyon Heart Trial also provides evidence of the benefits of a Mediterranean-type diet rich in α -linolenic acid (ALA), an n-3 fat (171).

Irrespective of fat intake, elevated total plasma homocysteine (tHcy) is associated with a higher risk of CVD as well as low serum folate levels (172). Increasing folate intake from foods, through fortification or with folic acid supplements, improves folate status (173) and can reduce total plasma homocysteine levels in women (174,175), thus potentially lowering the risk of CVD (176). Eating more folate-rich foods increases other nutrients such as fiber, phytochemicals, and several micronutrients, while indirectly lowering intakes of fat. Caffeine (177,178) and alcohol (178) may unfavorably affect tHcy metabolism, whereas vitamins B-6 and B-12 may have beneficial effects (178).

Hypertension affects 52% of women over 45 years of age and is another risk factor for CVD. Hypertension can be significantly decreased with a diet rich in low-fat dairy products and generous amounts of fruits and vegetables, as shown in the Dietary Approaches to Stop Hypertension Diet

(DASH) (179). Such changes in eating habits, along with a reduction of dietary sodium, can reduce blood pressure in normotensive, as well as hypertensive individuals (180). Sodium intakes greater than 2,600 mg/day are considered a strong independent risk factor for CHF among overweight individuals (181). This is especially relevant to overweight women who are particularly vulnerable to CHF (182).

The revised Dietary Guidelines of the American Heart Association (AHA) (167) represent a major shift from a specific focus on limiting total dietary fats to a greater emphasis on protective foods and on the diet as a whole. Data from the Nurse's Health Study, which found a cardioprotective benefit of a prudent eating pattern (ample amounts of fruits, vegetables, whole grains, legumes, and fish and less refined grains, potatoes, and red and processed meats), when compared with a Western-type diet, support this new paradigm (183). Among pending issues, the increased availability of fat substitutes and increased use by consumers requires long-term study to assess the true benefits because many foods that incorporate fat substitutes also may contain high levels of refined carbohydrates (184).

In summary, dietetic professionals need to be aware of important paradigm shifts related to the prevention and treatment of CVD. New risk factors, which include novel proteins and genetic polymorphisms, need to be considered. MNT should go beyond the traditional lipid modification strategy. Plant foods (rich in folic acid and soluble fiber), fish, nuts and seeds (rich in n-3 fatty acids), greens (rich in magnesium and potassium), whole grains (rich in micronutrients and low in glycemic load) (185), and soy and vegetable oils (rich in monounsaturated fats) all provide strong evidence-based benefits. Low-fat dairy products also have been shown useful to lower blood pressure (179). The specific effect of moderate amounts of wine and specific recommendations for women are pending further research (186). The lifestyle approach that provides the most protection includes a healthful diet, weight control, regular physical activity, and abstinence from smoking. The reader is

referred to Figure 1 for a summary of risk and protective factors.

Cancer

Cancer is the second leading cause of mortality in North America and is responsible for one out of four deaths (51,187). Cancer incidence and mortality rates among females in the United States and Canada closely parallel one another. The top three cancers among North American women are as follows: cancer of the breast (accounting for ~31% of incident cases and ~15% of cancer deaths); cancers of the lung and bronchus (accounting for ~12% of incident cases and ~25% of cancer deaths); and cancers of the colon and rectum (accounting for ~12% of incident cases and ~11% of cancer deaths) (51,187). Differentials between incidence and mortality largely reflect poorer cure rates for lung cancer in general, as well as later stage at diagnosis for both lung and colorectal cancers. Because early detection is a key factor in controlling many types of cancer, North American women are encouraged to follow cancer-screening guidelines established and periodically updated by the National Cancer Institute (United States or Canada) or the American or Canadian Cancer Societies (188,189). Later stage at diagnosis tends to be a pervasive problem among underserved populations, ie, Native Americans (Aleuts and American Indians), African Americans, and Hispanics, and contributes to increased cancer-related mortality and morbidity, therefore underscoring the need for both increased primary and secondary prevention efforts in these groups (51,187). Gynecologic cancers of the cervix, endometrium (uterine corpus), and ovary also are a cancer concern among North American women but are less prevalent and, in total, only comprise ~12% of incident cases and ~8% of cancer deaths (51,187).

Cancer is an umbrella term used to describe over 100 different conditions characterized by uncontrolled cell growth (51). Given the disease heterogeneity, risk factors differ considerably among different cancers, such that risk factors identified for one cancer are not necessarily the risk factors for another (190). There are some commonalities that exist;

namely, cancer tends to be slightly more prevalent among males than females and also is a disease associated with aging (51,187). Roughly 77% of cancers are diagnosed at age 55 or older (51). Although major single gene mutations in familial cancer syndromes are responsible for up to 15% of cancers, a recent study suggests that the overwhelming cause of cancer is because of external factors, such as tobacco, environmental and occupational exposures, alcohol use, or diet (51,190-194). It is estimated that roughly one-third of cancer-related mortality is attributable to dietary or nutritional factors, including those that mediate energy balance or body weight status (192,195,196). Given the heterogeneity of the disease, however, this estimate is imprecise and ranges from 10% to 70%, depending on cancer type, gender, and other factors (195,197). The science in the area of diet and cancer is not as developed as that between diet and other disease, such as CVD. However, large-scale studies are currently underway that will more clearly elucidate associations between various nutrients and cancer (197). Discoveries, particularly in areas of diet-gene interactions, as well as intermediate end points (eg, a biomarker for cancer that is the equivalent of cholesterol in CVD) are likely to have a major impact in this area (190,193,198,199). Results of this work will temper guidelines that were previously constructed today and well into the future.

Evidence-based guidelines from the American Cancer Society and the World Cancer Research Fund/American Institute for Cancer Research (200,201) form the basis of current dietary recommendations and encourage the consumption of plant-based diets that rely on minimally processed food and that promote healthy weight control along with a physically active lifestyle. Although the possible benefits of supplemental folate, calcium, and selenium are acknowledged, these organizations advocate that nutrients be provided by a well-balanced diet, instead of in the form of supplements (192,200,201). See Figure 1 for general risk and dietary factors associated with cancers of the breast, lung, colorectum, endometrium, cervix, and ovary.

In conclusion, the study of diet and

cancer prevention is fairly new and is likely to evolve quickly with gene discovery and the elucidation of intermediate end points. Dietetics professionals need to be aware of these discoveries to target women who are most at risk and to provide appropriate guidance (making sure that nutritional advice is supported by a consensus of well-designed trials). At present, the basis of medical nutrition therapy should be focused on the guidelines established by the American (51) and Canadian Cancer Societies (189) and the World Cancer Research Fund (64)/American Institute for Cancer Research (201), which call for healthy weight control throughout the life cycle via a physically active lifestyle and the consumption of a healthful diet that includes a variety of minimally processed foods, with an emphasis on plant sources.

Osteoporosis

Osteoporosis is a complex, multifactorial condition characterized by reduced bone mass and architectural deterioration, leading to an increased susceptibility to fractures. Osteoporosis is a silent disease; it occurs without overt symptoms. It is the most common bone disease in humans and is developing into a major public health problem worldwide. Osteoporosis and low bone mass (osteopenia) currently affect over 45 million North American adults aged 50 years and older (202,203). Eighty percent of those affected by osteoporosis are women, and all ethnicities are affected (126). Forty percent of non-Hispanic black women, 59% of Hispanic, and 72% of non-Hispanic white and Asian women over the age of 50 years are estimated to have osteoporosis or osteopenia (202). One in two women will suffer an osteoporotic-related fracture once in her lifetime (126). Dual-energy x-ray absorptiometry (DXA) is the technical standard for measuring bone mineral density (BMD); a low BMD is a strong predictor of fracture risk (126).

Osteoporotic-related fractures are particularly devastating to older women, frequently confining them to long-term care with, often times, fatal outcomes. In 2001, the estimated direct expenditures (hospitals and nursing homes) for osteoporotic and associated fractures in the United

States were \$17 billion (202). In Canada alone, the cost of treating osteoporosis and the resulting fractures is estimated to be \$1.3 billion annually, with expectations that the number will grow to \$32.5 billion in the year 2018 (203).

For most people, osteoporosis is largely preventable. Because there is currently no cure for the disease, prevention is crucial. Osteoporosis prevention is best accomplished by maximizing peak bone mass during growth (childhood and adolescence) (204) and by maintaining a healthy lifestyle throughout life to keep bones strong. There are four critical factors in preventing osteoporosis: (a) a balanced diet rich in calcium and vitamin D, (b) weight-bearing exercise and a healthy lifestyle with no smoking or excessive alcohol intake, (c) routine bone density measurements to monitor and screen for osteoporotic changes, and (d) the use of medications when appropriate (126).

Osteoporotic-related fractures are particularly devastating to older women, frequently confining them to long-term care with, often times, fatal outcomes.

Nutrition is an important modifiable factor in the development and maintenance of bone as well as the prevention and treatment of osteoporosis. Of all the nutrients or food components that affect bone, calcium and vitamin D are the most important. Ninety-nine percent of the body's calcium is found in bone. Bone is living tissue that constantly undergoes formation and breakdown, otherwise known as bone turnover. There is little doubt that bone turnover is responsive to dietary calcium, regardless of age. In an exhaustive review of the scientific literature, Heaney (205) found that, in 70 controlled calcium intervention studies, 68 studies showed that dietary calcium resulted in either improved bone balance, greater bone gain during growth, re-

duced bone loss in older individuals, and/or reduced fracture risk. The positive effects of supplemental calcium are most pronounced when the baseline calcium intakes are already low to moderate. Dietary calcium strengthens bone by suppressing parathyroid hormone and bone resorption (205-208).

Actual calcium intakes among United States women (209) are considerably lower than the current Dietary Reference Intakes (DRIs) (210). Inclusion of low-fat dairy products in the diet is the most desirable way to meet calcium goals (211). With the recent increases in requirements, it is difficult to achieve an adequate intake when dairy products are eliminated from the diet. For individuals who cannot consume enough calcium-rich foods, calcium supplements are needed.

Vitamin D is a major determinant of intestinal calcium absorption and is required for normal bone metabolism. Subclinical vitamin D deficiency is fairly common in certain subpopulations, such as medical inpatients (212,213) and homebound elderly adults (214-217), and vitamin D insufficiency also is common among younger women and adolescents, particularly during the winter months (218-220). The result of poor vitamin D status is poor intestinal calcium absorption, secondary hyperparathyroidism, accelerated bone loss, mineralization defects, and increased risk for fractures (215,216,221). The incidence of rickets, once believed to be very rare, is now on the rise (222-226).

Given inadequate vitamin D status among a high proportion of older individuals, the most recent DRIs have substantially increased vitamin D requirements in those over age 50 years (210). There are few foods that are naturally rich in vitamin D; therefore, milk in the United States and Canada is fortified with vitamin D to the level of 2.5 μg (100 IU) per serving. A current position statement on the management of postmenopausal osteoporosis is now available (227). In summary, osteoporosis is a largely preventable disease. Although genetics play a large role in bone health, our skeleton responds (albeit silently) to the nutrients we consume, the physical activities we participate in, the lifestyle we lead, and our hor-

American Cancer Society: <http://www.cancer.org>
 American Diabetes Association: <http://www.diabetes.org>
 American Dietetic Association: <http://www.eatright.org>
 American Heart Association: <http://www.americanheart.org>
 American Institute of Cancer Research: <http://www.aicr.org>
 American Obesity Association: <http://www.obesity.org>
 Canadian Diabetes Association: <http://www.diabetes.ca>
 Canada Health Network: <http://www.canadian-health-network.ca>
 Canadian Women Health Network: <http://www.cwhn.ca>
 Dietitians of Canada: <http://www.dietitians.ca>
 International Osteoporosis Foundation: <http://www.osteofound.org>
 National Association of Anorexia Nervosa and Associated Disorders: <http://www.anad.org>
 National Eating Disorders Organization: <http://www.nationaleatingdisorders.org>
 National Institutes of Health: <http://health.nih.gov/search.asp/29>
 National Institutes of Health, Osteoporosis, and Related Bone Diseases, National Resource Center: <http://www.osteo.org>
 Women's Health Initiative and Office of Research on Women's Health: <http://www.4woman.gov/owh>
 National Osteoporosis Foundation: <http://www.nof.org>
 Osteoporosis Society of Canada: <http://www.osteoporosis.ca>
 Weight Control Network: <http://www.niddk.nih.gov/health/nutrit/nutrit.htm>

Figure 2. Recommended Internet sites in the area of nutrition and women's health.

monal status. The dietetics practitioner should guide women of all ages on how to modify these controllable risk factors to improve the health of their skeleton throughout life, from childhood to late adulthood.

APPLICATIONS FOR DIETETICS PROFESSIONALS/CONCLUSIONS

Women are at unique risk for certain nutrition-related diseases and conditions. Moreover, women's health-related issues are multifaceted. In addition to racial and ethnic background, determinants such as level of education, socioeconomic status, health care access, employment, family responsibilities, household composition, and social support may all affect women's health care behaviors and beliefs. Furthermore, dietitians must consider the evolving influence of media and technology (228) on health care practices. By being familiar with credible Internet sites, dietetics professionals can appropriately guide women in their use of health-related information. Figure 2 provides a current listing of recommended Internet sites in the area of nutrition and women's health. A woman's community infrastructure may also affect opportunities for a healthy lifestyle. Dietetics professionals can help promote healthful eating habits, which include helping women gain access to a wide variety of foods, as well as increasing opportunities for in-

creased physical activity in schools, colleges, places of employment, senior centers, and the communities at large. Given that nutrition can favorably influence a woman's health and decrease the risk of chronic diseases, dietetics professionals strongly support research, health promotion activities, health services, and advocacy efforts that will enable women to adopt desirable nutrition practices for optimal health.

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