Nutrition Considerations of Girls and Women

6

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Keywords

Female athlete triad · Polycystic ovary syndrome · Premenstrual syndrome · UTI

Key Points

- Reproductive anatomy and function affect nutrition, appetite, and weight regulation, with effects on female health distinct from those of males.
- Most chronic diseases in women, like men, have diet associations that affect health risk, management, and outcomes. Lifestyle modification, including nutritional intervention, should be considered a first-line intervention when applicable.
- Cultural and social factors that emphasize gender-specific roles, body shape, and weight in females increase the risk of disordered eating and likelihood that women will seek assistance with medical and/or nonmedical management of weight.
- Neural and hormonal regulation of appetite varies by gender and among females at different stages of the life span; these differences may affect success of nutritional and medical management of body composition and appetite.
- The (female) athlete triad, a condition involving inadequate energy intake, menstrual dysfunction, and lowered bone mineral density, is most often recognized in female athletes due to activity-associated pain and stress fractures but also occurs in more sedentary girls and women.
- Polycystic ovary syndrome (PCOS) is associated with the metabolic syndrome including overweight or obesity, insulin resistance and associated glucose intolerance, carbohydrate craving, disordered eating, and other metabolic anomalies. Weight and drug management (with antidiabetics and spironolactone) and attention to carbohydrates, chromium, and cinnamon in the diet may improve insulin sensitivity and reduce negative outcomes.
- Urinary and genital tract conditions may be associated with dietary strategies.
- Women may seek nutritional and medical management strategies for age-related weight and body changes and for relief of premenstrual and peri- and postmenopausal symptoms.

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Introduction

There are long-recognized associations among female gender, fertility, and food, reflected in imagery of iconic goddesses and mothers. Nutrients may impact, and be impacted by, menstrual cycling, fertility, pregnancy, labor and delivery, lactation, and peri- and postmenopausal adaptations [1]. In addition, reproductive function in women has long-lasting effects on other body systems, such as the skeletal system. Therefore, clinicians providing care for girls and women need a solid understanding of unique nutritional considerations specific to females.

It should also be emphasized that the leading causes of death in women – heart disease, stroke, and cancer (especially breast cancer) – are all associated with diet and other lifestyle factors [2]. Recommendations related to prevention of chronic disease put forth in the Dietary Guidelines for Americans 2015–2020 [3] are applicable to girls and women. Key elements include limiting daily calories from sugars and saturated fats each to less than 10% of total calories; limiting sodium to less than 2300 mg/day; and limiting alcohol intake to one drink per day for women, a notable difference from previous recommendations being the absence of defined limits for intake of total fat and cholesterol [3]. Consumption of a high-quality nutrient-dense diet (calcium, vitamin D, n-3 fatty acids, antioxidants), fewer and less processed foods, and emphasis on plant-based foods are generally recommended to lower chronic disease risk and adverse outcomes [3]. Risk is also lowered with maintenance of a healthy weight (body mass index <25 with waist circumference <35 inches) [2].

Specific Nutrient Considerations for Females

Dietary Fat

No significant associations of total dietary fat with cardiovascular disease risk are included in the current recommendations. However, types and sources of dietary fat are still of great interest and are a topic discussed by Sapp, Petersen, and Kris-Etherton in Chap. 29. While reduction of total fat leads to reduced intake of saturated and trans fats, which have been related to higher risk, it may also lead to reduced intake of unsaturated fats, some of which are related to lower risk. Women's cohort and intervention studies do not support a significant association between total fat intake and risks of breast and colorectal cancers [4]. Consumption of vegetable fats has been associated inversely with diabetes development in women [4]. However, a recent systematic review of studies of high-fat dairy consumption reported either no association or an inverse association with obesity and associated cardiometabolic risk [5]. A recent cohort study revealed that higher fat dairy consumption was associated with less weight gain in middle-aged and older women [6].

Iron

Women of reproductive age are at greater risk of anemia due to iron loss during menstruation and reduced dietary iron intake. Increased anemia risk is associated with heavy or frequent menses, frequent blood donation, and athletic-induced hemolysis and anemia [7]. Signs and symptoms of non-anemic iron deficiency may include fatigue, restless legs, sleep disturbance, and fingernail breakage. Routine iron supplementation for those without iron deficiency is not recommended. When iron deficiency is present, supplementation is recommended as well as education on the difference between heme and non-heme iron sources with regard to bioavailability. Non-heme iron is better absorbed in the presence of meat protein and should be consumed in the same meal with foods rich in vitamin C so as to enhance absorption [7]. Iron deficiency in women who are not menstruating may merit exploration of nutrition intake or occult bleeding from gastrointestinal sources [8].

Folate and Vitamin B_{12}

Adequate periconceptional and pregnancy intake of folate is well known to decrease the risk of neural tube defects and may also help prevent other complications of pregnancy including preeclampsia and miscarriage [9]. Repeated miscarriages and infertility have been linked to insufficient amounts of vitamin B_{12} and folate. Pregnancy and lactation increase the need for both of these micronutrients. Women with history of limiting animal protein sources, such as vegans and vegetarians, during pregnancy or lactation are at higher risk of vitamin B_{12} deficiency and may need supplementation. In older women, vitamin B_{12} deficiency has also been associated with increased hip bone loss [10].

Calcium

Adequate calcium is recommended for women of all ages, especially during adolescence and in young women; this is because peak bone mass is developed during the growing years, up to age 30 [2], as is more thoroughly discussed in Chap. 11. Because of common preoccupation of girls and women with weight, they may consume low levels of foods containing calcium, for instance, replacing milk with diet drinks. Promotion of three servings per day of low-fat dairy products that provide both calcium and vitamin D is recommended. If a vegetarian lifestyle or lactose intolerance are considerations, other calcium-fortified beverages or foods, such as orange juice, or a calcium and vitamin D supplement may be warranted. Though small increases in bone mineral density (BMD) have been observed in studies reviewed, a recent meta-analysis does not report increased dietary calcium or calcium supplementation, beyond general recommendations, as likely to be beneficial in persons over age 50 years [11].

Premenstrual Symptoms, Dysmenorrhea, and Nutrition Associations

Premenstrual Symptoms and Nutrition Associations

Premenstrual symptoms, both physical (breast tenderness, bloating, headache, etc.) and mental (depression, mood swings, irritability, sleep disturbance, etc.), can range from mild to debilitating. Dietary modifications for preventing or reducing premenstrual symptoms have included reductions in salt, sugar, caffeine, whole grains, and meal sizes and multiple botanicals [12, 13]. Diets enriched with whole grains where shown to reduce premenstrual syndrome scores. Individual nutrients, including vitamins B_6 and E, calcium, vitamin D, and magnesium, as well as some herbs, have been linked to improved management of premenstrual symptoms (premenstrual syndrome (PMS) and premenstrual dysphoric disorder (PMDD)) [12, 13]. A review of this area concluded that calcium supplementation (1200 mg/day in divided doses), vitamin B_6 in doses up to 50–100 mg/day, and 20–40 mg/day of chasteberry (*Vitex agnus-castus*) show limited evidence for reduction of one or more premenstrual symptoms [12]. Generally well-controlled studies have not demonstrated much improvement over placebo and may not merit the potentially harmful side effects with routine use. Additional lifestyle interventions with limited evidence base include regular exercise, relaxation, and stress reduction interventions for ameliorating mild to moderate symptoms. Certain SSRIs are considered first-line pharmacotherapy for more severe PMS or PMDD [12, 13]. Additional botanicals including *Angelica sinensis* (dong quai), *Viburnum opulus* and *Viburnum prunifolium* (cramp bark and black haw), *Zingiber officinale* (ginger), *Valeriana officinalis* (valerian), and *Oenothera biennis* (evening primrose) have been studied, although effective PMS treatment has been difficult to document. Myometrial relaxation, anti-inflammatory, and/or various receptor activities have been suggested as mechanisms of actions for active agents in these botanicals [12].

Dysmenorrhea and Nutrition Associations

Dysmenorrhea, the most common gynecologic complaint in females, has varied levels of severity and comorbid conditions. A small number of studies have explored thiamin, magnesium, vitamin E, or n-3 fatty acids and some of the aforementioned botanicals for their effectiveness at alleviating painful menses with limited or nonconclusive results [12].

Females, Body Dissatisfaction, and Nutrition

Girls and women of all ages, many ethnicities, and environments report struggling with body dissatisfaction that may affect nutrition [14]. This dissatisfaction may lead females or their loved ones to express concern and seek healthy or unhealthy ways to change their bodies [15]. While girls and women of all ages report dissatisfaction with their bodies, as women age the self-reported importance of their body shape and size declines [14]. Girls and boys undergo great body changes during adolescence, and sometimes into early adulthood, that can impact body image [15]. Females have monthly body changes associated with menstrual cycling, enormous changes in physical size and shape associated with pregnancy and postpartum, as well as changes in body composition and fat deposition associated with midlife hormonal changes. Referral of girls and women (as well as boys and men) for counseling to explore and resolve body image as well as aging issues may improve nutrition outcomes and mental and physical health. The passage of mental health parity legislation should improve treatment options for individuals and families struggling with eating and body image disturbances.

Weight Management in Females

Body Weight and Reproduction

Weight issues should be addressed with women who are underweight or overweight; this is necessary for both health and reproductive reasons. Help should also be offered to women who have significant anxiety about weight and shape changes associated with varied life stages. Very high or low body mass index (BMI >35 or <20, respectively) are associated with reduced probability of conceiving; this is related to leptin and gonadal axis dysregulation [16]. Pregnancy and peripartum complications as well as the health of prospective children [17] are affected by prepregnancy weight and maternal weight gain. Women should be assessed for disordered eating before they are advised to gain or lose weight; this assessment should continue while they are gaining or losing weight. A history of dieting and dietary restraint has been associated with increased weight gain during pregnancy in all but underweight women [17]. The health benefits of ideal weight range for both mother and prospective children should be emphasized. Risks and management of overweight and obesity are discussed further in Chap. 9. Generally, if weight loss intervention is needed in nonpregnant and non-lactating women, a diet supplying 1200–1500 kcal/day or 500 kcal/day deficit is recommended with recognition that choosing a nutritious diet that is most likely to be adhered to is more important than macronutrient composition (low fat, low carb, etc.) [2, 18].

Recent gut microbiome studies have revealed that maternal intestinal flora, which have significant associations with body weight, metabolic syndrome, and diet, affect not only maternal health but may also affect fetal gut microbiome and postnatal health outcomes [19]. Inclusion of probiotics in the diet has been shown to increase glucose tolerance and reduce risk of gestational diabetes in pregnancy, perhaps reflecting change in gut microflora [20].

Overweight, Obesity, and Weight Loss Considerations

Both obesity and eating disorders (as a group) are more common in females than males in developed countries. Although there is a well-known difference in body fat distribution among most women versus most males, the interaction of factors dictating gender-specific fat storage and mobilization are not clear. Multiple appetite-regulating hormones are currently under investigation for their roles in energy balance and inappropriate imbalance [21]. Weight management and appetite regulation in girls and women are complicated by gender-specific roles as family meal preparers, menstrual cycle fluctuations, major changes in sex hormone levels at the onset and end of the reproductive years, and body weight and shape changes associated with pregnancy and lactation [21]. When weight reduction is indicated, strong evidence-based recommendations include prescription of individualized nutritionally adequate diets designed with regard to patient preferences and other health considerations. Caloric intakes from 1200 to 1500 kcal/day or energy deficit of approximately 500 to 750 kcal/day for women are recommended. Macronutrient densities ideal to promote compliance with caloric deficit and consumption of most calories earlier in the day have been shown to improve success [18].

Success rates for weight-loss maintenance in overweight women and recovery from eating disorders are not encouraging. Eating disorders are explored in more detail by Allison and Bruzas in Chap. 23. It is important for clinicians to recognize that a one-size-fits-all approach to the treatment of disordered eating issues and weight management is likely less effective than individualized nutrition assessment and management approaches. Evidence is mixed with regard to whether reasonable calorie restriction is effective in the long term or if it predisposes to eating disorders; however, any dieting should be done with caution, supervision, and with adequate dietary carbohydrate and protein to preserve lean body mass. There is also evidence that a size-acceptance approach (health at all sizes) that emphasizes attention to internal hunger, satiety, and appetite cues may improve health and self-esteem more than dieting [22].

The Female Athlete Triad

The female athlete triad (TRIAD) is a spectrum disorder that involves three interrelated conditions, which may profoundly affect the skeletal and reproductive health of girls and women: inadequate energy intake, menstrual dysfunction, and lowered BMD [23]. Inadequate energy intake leading to promotion of the other two conditions may occur with or without eating disorder and in girls and women in all weight categories. The prevalence of the TRIAD varies depending on the age group, number, and definition of components [23]. Athletes with the TRIAD are at significantly higher risk of sports-related injuries and declining performance. Screening for the TRIAD should occur at physical examinations [24]. Detected presence of any one of the TRIAD components with screening or patient presentation of amenorrhea, stress fractures, or low body weight indicates assessment for the other two components. It is recommended that the diagnosis of the TRIAD should be followed by comprehensive evaluation and intervention, including a primary care provider, a behavioral health professional, and registered dietitian [23]. Key considerations for the assessment of the TRIAD and for intervention planning are shown in Table 6.1.

The goals of treatment are normalization of eating patterns and weight, nutrition education and oversight to ensure energy balance (caloric intake ≥ caloric expenditure), restoration of regular menses, and elevation of BMD. BMIs for resumption of regular menses may be higher in athletes than that required in more sedentary females. Rest (exercise restriction) may also be required for the restoration of normal physiological and reproductive function. Behavioral health support may be needed to help athletes deal with associated feelings of guilt or loss because of not exercising. Protein, calcium, and vitamin D consumption should also be monitored for adequacy. Oral contraceptive therapy to replace

Table 6.1 Assessment for diagnosis, monitoring, and evaluation of the female athlete triad

Assessment category	Key tools
Screening and behavioral	Preparticipation physical exam [24], EDI, EAT-26, SCOFF, etc. Interview to assess body image, food, and/or exercise focus
History	Weight, diet, physical activity, social, medical (evidence of bone injuries, pain)
Anthropometrics[a]	Height, weight, BMI calculation, application to ideal body weight (IBW) range and % IBW, % UBW if recent weight loss
Dietary	Use 24-hr or usual day recall, dietary log, direct observation, and/or interview of parents as applicable
Laboratory	Glucose, protein, iron status, CBC, gonadal axis hormones
Body composition[a]	Bone density (whole body and regional), % fat mass

[a]Body image concerns considered if sharing this information with the patient

Table 6.2 Clinical features and related medical or lifestyle and dietary interventions for PCOS

Clinical feature	Medical or surgical intervention	Lifestyle/dietary intervention
Hyperandrogenism	Spironolactone	Phytochemicals
Dysmenorrhea	Contraceptives Ovulatory induction with clomiphene citrate or letrozole	Phytochemicals
Android pattern Overweight/ obesity	Orlistat Phentermine	Support for achievement and maintenance of lower body weight through dietary and exercise interventions Screening and support for BED/NES eating disorders
Insulin resistance	Metformin Thiazolidinediones GLP-1 mimetics[a] DPP-4 inhibitors[a]	Focus on carbohydrate amount and type, inclusion of chromium and cinnamon
Ovarian cysts		Phytochemicals
Hirsutism, alopecia	Topical 5-alpha reductase inhibitors	Zinc supplementation

[a]Under investigation

estrogen with amenorrhea is controversial and has not been effective in preserving BMD as intended. Hormone challenge may be helpful for jump-starting menses following weight restoration. Noncompliance with the treatment plan and/or continued amenorrhea indicates the need for more intensive behavioral and medical therapy to prevent poor present and future health outcomes [23, 24].

Polycystic Ovarian Syndrome

Polycystic ovarian syndrome (PCOS), also known as Stein-Leventhal syndrome, is associated with an array of clinical features and management options shown in Table 6.2. The prevalence of the condition is estimated to be 5–15% of women of reproductive age, and there is often family history of PCOS or its signs [25, 26]. Besides the well-known difficulties with fertility that women with PCOS can experience, the metabolic disturbances significantly increase the risk of developing type 2 diabetes and cardiovascular disease [1, 25, 26].

Indications of hyperandrogenism in women include *hirsutism* (male pattern hair growth in females), acne, dysmenorrhea, and alopecia (head hair loss). The presence of insulin resistance and hyperinsulinemia is suggested by episodic hypoglycemia and related carbohydrate craving, acanthosis nigricans (dark patches on the skin), and unexplained weight gain. Other symptoms that may also be present include significant mood disorder, body image disturbance, and disordered eating, secondary to attempts to control weight gain. Results of sex hormone tests, standard diagnostics for diabetes

(fasting glucose and insulin, oral glucose tolerance test, HbA1c), and transvaginal pelvic ultrasound may provide differential diagnosis [25, 26].

Dietary management of PCOS should emphasize foods low in saturated fat and high in fiber. In addition, specific nutrients, plant extracts, and supplements, including *Cinnamomum* sp., inositol, and fish oil, have been explored to reduce clinical features of PCOS, with a recent meta-analysis identifying no high-quality evidence for their effectiveness [26]. Counseling may also be indicated for mood disorder and helps with body image and acceptance and disordered eating if present [24, 25]. Regular exercise, including both strength-building (resistance) and endurance components, will assist with weight loss, improve insulin sensitivity, and increase self-esteem. Medical management of sex hormone dysregulation may involve drugs to regulate menses, stimulation of ovulation, and inhibit masculine hair patterns and acne. Medical management of metabolic dysregulation may involve drugs to improve insulin secretion and sensitivity, reduce hepatic glucose output, improve dyslipidemia, and promote weight loss. Early detection and management of PCOS, or the proposed male equivalent (androgenic alopecia), can improve physical and mental health outcomes and reduce the risks of chronic diseases and infertility later in life [24, 25].

Peri- and Postmenopausal Nutrition

The peri- and postmenopausal periods may pose challenges for women's health and well-being that may be influenced by diet [12]. This topic is discussed in greater detail in Chap. 8, which deals specifically with this stage of life including considerations of diet, hormone replacement therapy, and supplement use, and Chap. 11, which deals specifically with related changes in bone health during this life cycle transition. A healthy diet, weight-bearing exercise, avoiding smoking, and limiting alcohol intake can prevent bone loss as well as promote healthy body weight and image in the postmenopausal period [2]. Cooperative diet, alcohol and supplement assessment, and referral to reliable sources for exploration of the evidence base for supplement use will help patients make informed decisions.

Urinary and Genital Tract Conditions

Bacterial and Fungal Vaginosis

Bacterial and fungal vaginosis are common conditions, especially in immunocompetent and immunocompromised women. Various specific probiotic strains administered vaginally or orally in clinical have been shown to improve bacterial vaginosis and in some cases antibiotic co-treatment efficacy. Consumption of yogurt with live cultures may be an advisable dietary intervention in women who are at risk or have recurrent or drug-resistant conditions [27, 28].

Urinary Tract Infections (UTI)

Women are 30 times more likely to suffer from urinary tract infections throughout their lives compared with men [12]. They are also more likely to develop infection-related stones which are also associated with higher urinary pH. Besides microbiota mentioned above, cranberries and cranberry juice have been shown to help with the treatment of UTI. The proanthocyanidins in these fruits and their juices are associated with reduction in adhesion to urinary tract mucosa of the most common infective *E. coli* strains. The effective dose has been elusive due to cranberry strain variations in proanthocyanidin contents [12]. Adequate water intake should also be encouraged for the prevention of UTI and all types of kidney stones.

Interstitial Cystitis/Bladder Pain Syndrome

Women are more likely to experience interstitial cystitis/bladder pain syndrome than men [29]. This condition is associated with debilitating urinary tract pain and urinary frequency and urgency of urination. Recent studies have shown benefit of diet manipulations that seek to exclude irritating foods, often including coffee, tomatoes and tomato products, soybean products, specific spices, citrus, and those with excessive potassium [29, 30]. As with any elimination-type diet, reporting of symptoms and tolerance with the help of a dietitian can reduce the likelihood of malnourishment due to unnecessary elimination of nutritious foods.

Summary

Helping girls and women navigate the vast, often contradictory, dietary information related to female-specific issues is a challenging task that may be asked of primary care providers. Anthropometrics, diet and eating pattern analyses, and questions about body image and satisfaction should be routine aspects of annual physical examinations. This is especially important during puberty, pregnancy, and postpartum and perimenopausal periods. These may help detect and monitor conditions that warrant special nutritional, medical, and/or exercise interventions that will improve girls' and women's health and well-being.

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Suggested Further Readings

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