Nutrition’s Role in Premenstrual Syndrome — Learn About This Disorder and the Role Genetics, Environment, and Diet May Play in Its Onset
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Although most women likely have experienced it at some point in their lifetime, premenstrual syndrome (PMS) isn’t easily defined. According to the American Congress of Obstetricians and Gynecologists (ACOG), it’s a group of physical or mood changes that occur one to two weeks before menstruation. Symptoms usually stop once a woman’s period begins.¹

On average, the typical menstrual cycle lasts 28 days, yet may range from 21 to 34 days. There are two phases of the menstrual cycle. The follicular phase precedes ovulation and occurs from day one (when menstruation begins) through day 13 (the day before ovulation). The luteal phase, which occurs from days 15 to 28, is associated with PMS. During this phase, estrogen and progesterone levels rise in preparation for pregnancy and fall if it doesn’t occur.²

A true estimate of the prevalence of PMS varies,¹ but roughly 85% of women display at least one PMS symptom during their monthly cycles. Many of these women will display mild symptoms that don’t necessarily require treatment. Less than 20% of symptomatic women meet the clinical diagnosis for PMS, and a smaller percentage, less than 10%, have a more severe form of the syndrome called premenstrual dysphoric disorder (PMDD). It’s widely known that certain foods, such as alcohol, salt, and sugar, can make symptoms worse, but in order to help their clients who suffer on a monthly basis, RDs should be aware that there’s a much larger nutrition component to premenstrual syndrome.

This continuing education course explores PMS and the role genetics, environment, and diet may play in its onset. It also discusses related nutrient deficiencies and specific food recommendations RDs can provide in public and private health settings.

**Symptoms**

More than 200 symptoms of PMS have been identified, and, as noted previously, it’s estimated that 85% of women display at least one symptom during their monthly cycles.¹,³ Moreover, 85% to 90% of menstruating women regularly experience emotional and/or physical symptoms before their periods start. Roughly 8% to 20% of these women experience symptoms that meet the clinical definition of PMS.⁴ Most often, women suffer from depression, irritability, fatigue, abdominal cramping, breast tenderness, and headaches.⁵

The other most commonly reported physical symptoms include abdominal bloating, fluid retention, constipation or diarrhea, headaches or migraines, changes in appetite, weight gain, acne, and muscle or joint aches. Among the emotional symptoms women may experience are
depression, anxiety, insomnia or sleep disturbances, change in sex drive or interest, irritability, anger or hostility, mood swings, difficulty concentrating, crying, and fatigue.¹,²

Food cravings also are a common complaint of women who experience PMS. Cravings tend to revolve around carbohydrate-rich foods, particularly sugar, and also alcohol. This may be because carbohydrates provide tryptophan, the precursor to serotonin.⁶ A craving for or an increase in carbohydrate intake is likely a manifestation of the body’s attempt to increase serotonin levels, which ultimately helps to improve mood.⁷

While carbohydrates can help improve mood, there’s an important distinction to make between the effects of complex vs refined carbohydrates: When cravings lead to an increased intake of simple refined carbohydrates, insulin levels can spike, causing not only fluid retention, but also potentially increasing the excretion of magnesium through the urine.⁶ ⁷

What Causes PMS?
The causes of PMS remain unclear. Most likely, there isn’t one clear cause; a number of different factors, both physiological and psychological, may be involved. Much of the scientific evidence points to monthly hormonal fluctuations and the effect they can have on neurotransmitters.³ Initially, it was thought that women who experience PMS might have abnormal levels of hormones or suffer from some sort of hormonal dysregulation. Recent research, however, indicates that it’s likely not abnormal hormone levels at play, but rather that some women are simply more sensitive than others to these hormonal fluctuations.³

During the first part of the luteal phase of the menstrual cycle, estrogen and progesterone rise to their highest levels to prepare the body for pregnancy. If conception doesn’t occur, these levels will quickly drop in the second part of the cycle, resulting in menstruation.² Some researchers believe PMS may be more strongly related to a response to changing levels of progesterone and not necessarily to a change in estrogen levels.² A decrease in the amount of circulating progesterone leads to a decrease in progesterone metabolites, which, among other functions, act as a sedative in the brain, promoting calmness.

Higher levels of progesterone metabolites have been associated with milder PMS symptoms.⁸ The effect of a decrease in these metabolites has been compared to that of a drug withdrawal response and may be one reason some women experience symptoms of PMS.³ However, several studies have shown that evidence to support progesterone’s role in PMS is lacking, since progesterone levels don’t always change in women suffering from PMS, and progesterone supplementation in controlled trials hasn’t been shown to relieve symptoms.⁹-¹¹

Estrogen and progesterone are both involved in the regulation of two neurotransmitters: serotonin and gamma-aminobutyric acid (GABA). Serotonin helps to regulate mood and behavior, while GABA tends to promote calmness and ease anxiety.² Research suggests that women who suffer from PMS may have abnormal serotonin neurotransmission, leading to symptoms such as irritability, depressed mood, and food cravings.³
Who’s At Risk?
A number of factors may put a woman at higher risk of PMS than others. Women in their late 20s to early 40s tend to experience PMS more frequently than do women in other age groups. If a woman’s mother suffered from PMS, she’s also more likely to develop it. Women experiencing any sort of mood or anxiety disorder, including depression and postpartum depression, also are at higher risk of PMS. 

A study conducted in Switzerland by Tschudin and colleagues involving 3,913 women aged 15 to 54 examined the prevalence of PMS and related predisposing risk factors. Both PMS and PMDD were associated with poor physical health and psychological distress. Sociodemographic factors linked to a higher risk of PMS included advanced reproductive age, lower education level, and unemployment. Former, but not current, smoking behavior was found to be predictive of PMS, as was a BMI ≥30; however, it wasn’t significantly associated.

The most widely studied and significant risk factors are highlighted below. However, it’s important to note that poor eating habits; sugar, alcohol, caffeine, and sodium intake; and even stress have been implicated to some extent in the worsening of PMS symptoms. Vitamin and mineral deficiencies also may play a role, with calcium and certain B vitamins the most commonly referenced.

Obesity
While the study conducted by Tschudin and colleagues didn’t find a significant association, a BMI ≥30 was found to be predictive of PMS. Bertone-Johnson and colleagues examined this further, with individual studies nested within the Nurses’ Health Study (NHS) II. A BMI ≥27.5 was significantly associated with risk of PMS vs women with a BMI ≤20 over a 10-year follow-up period. Each 1 kg/m2 increase in BMI was associated with a 3% increase in risk. BMI also was found to be most strongly related to the following physical and emotional symptoms: swelling of extremities, backache, abdominal cramping, diarrhea/constipation, food cravings, crying, mood swings, and irritability. In this study, women between the ages of 18 and 30 who experienced weight cycling had a 36% higher risk of PMS vs those who didn’t report weight cycling.

Does obesity affect how neurotransmitters behave as well? Some studies have shown it’s possible. Lower estradiol levels have been associated with adiposity. Estrogen enhances serotonin action and, therefore, lower levels may impair serotonin functioning, contributing to symptoms of PMS. Adiposity also may contribute to the fluid retention often experienced by women with PMS, likely due to a dysregulation of the renin-angiotensin-aldosterone system. Estrogen stimulates this system, causing fluid retention, while progesterone seems to decrease it. Obesity has been associated with lower levels of progesterone; therefore, women with higher BMIs may experience fluid retention more frequently than those women with normal BMIs.

Alcohol
Another risk factor Bertone-Johnson and colleagues examined was alcohol use and whether it might predispose women to PMS/PMDD or whether women experiencing these symptoms were more likely to consume alcohol. Nested within the NHS II, this case-control study
looked at women aged 27 to 44 who were free of PMS at baseline in 1991. Results didn’t point to any significant relationship between regular alcohol intake and PMS incidence. Previous observational studies have identified a greater use of alcohol among PMS/PMDD sufferers; however, Bertone-Johnson and colleagues note that this may be attributed to an attempt to ease symptoms rather than being a cause of symptoms. And although it’s often recommended to decrease alcohol intake to reduce PMS symptoms, authors of this study feel this is mainly anecdotal advice.9,14

**Smoking**
Similar to alcohol use, there’s confusion as to whether smoking is involved in the etiology of PMS or whether women experiencing PMS smoke as a way to ease symptoms. Previous studies primarily have looked at smoking behavior among women who already suffer from PMS.15 Smoking may affect levels of estrogen and progesterone and has been associated with lower progesterone levels during the luteal phase.15 It also has been associated with higher testosterone levels, shorter menstrual periods, and more irregular cycles. Smoking may lower plasma vitamin D levels; lower levels have been correlated with PMS incidence and severity.15

Bertone-Johnson and colleagues examined this behavior as it relates to initial PMS development, again as a case-control study nested within the NHS II. They found that smoking, particularly during adolescence and young adulthood, may increase the likelihood of developing PMS. There was a higher risk of developing acne, anger, and backaches in women who smoked at ages 15 to 19.15 Bloating and breast tenderness were associated with smoking, but only at the time of PMS diagnosis, making it much more difficult to determine whether the behavior was a way to ease symptoms or whether it had an immediate effect on the severity or incidence of these symptoms.15 Contrary to this finding, Tschudin and colleagues found former, but not current, smoking behavior to be predictive of PMS.12

**How PMS is Diagnosed**
PMS is distinguished from normal premenstrual symptoms based on the degree of distress and disruption it causes.16 A clinical diagnosis requires that symptoms be recorded for at least two cycles and cause substantial distress or impairment of daily life. This assessment would include at home, at work, during social activities, and within interpersonal relationships.1,16,17

Women are advised to track their symptoms for two to three months to help doctors determine whether they’re experiencing PMS or another condition. If the reported symptoms consistently resolve after a woman’s period starts, they’re most likely due to monthly hormonal changes.1,18 If symptoms persist or cannot be linked to a specific part of a woman’s cycle, however, there may be other issues that should be explored. For example, there are a number of conditions that may either mimic, or overlap with PMS; these include the following:

- affective disorders (eg, depression, anxiety, dysthymia, panic);
- eating disorders such as anorexia or bulimia;
- chronic medical conditions such as diabetes;
- dysmenorrhea;
- endometriosis;
- perimenopause;
Because the symptoms and their severity vary greatly among women who experience PMS, specific criteria have been developed to help diagnose true PMS from more mild premenstrual symptoms.

The ACOG recommends the diagnostic criteria developed by the University of California at San Diego and the National Institute of Mental Health for proper diagnosis of PMS. The criteria emphasize timing and severity of symptoms and describe the following key elements necessary for diagnosis:

- The symptoms are consistent with PMS.
- There’s a consistent occurrence of symptoms only during the luteal phase.
- There’s a negative impact on daily functioning and/or lifestyle.

According to the National Institute of Mental Health, there should be a 30% increase in the intensity of symptoms from days five to 10 of the cycle as compared with the six-day interval before menstruation. In addition, there should be documentation of these changes in a daily symptom diary for at least two consecutive cycles.

The University of California at San Diego requires that in each of the three previous cycles at least one of the following emotional and physical symptoms be present during the five days before menstruation begins and shouldn’t be present from days four to 13 of the cycle. Emotional symptoms include depression, angry outbursts, irritability, anxiety, confusion, and social withdrawal. Physical symptoms, according to these criteria, can include breast tenderness, abdominal bloating, headache, and swelling of extremities.

PMS also can affect other conditions. The term “menstrual magnification” describes the worsening of certain conditions during the menstrual cycle. Migraines during or near menstruation tend to be more severe and last longer. Asthma attacks also tend to be worse during PMS. Chronic medical conditions including seizure disorders, multiple sclerosis, systemic lupus erythematosus, inflammatory bowel disease, and irritable bowel syndrome also may be exacerbated during PMS.

Is It PMS or PMDD?
PMDD is a severe form of PMS. As with PMS, the onset of symptoms typically occurs one week before menstruation and ends the week after. Symptoms are considered severe and occur over a period of at least one year. According to the DSM-IV of the American Psychiatric Association, the following four criteria are necessary for an individual to be diagnosed with PMDD:

- At least five of the following symptoms must be present the week before a woman’s period starts: depression, anxiety, mood swings, irritability, decreased interest in usual activities,
difficulty concentrating, fatigue, appetite changes, sleep disturbance, feeling overwhelmed, breast tenderness, headaches, joint or muscle pain, bloating, or weight gain.

• Symptoms must be severe enough to interfere significantly with daily functioning, such as avoiding social activities or decreased productivity at work.
• Symptoms must be specifically related to the menstrual cycle and not present as an exacerbation of an existing condition such as depression or panic disorder.
• As with PMS, these symptoms must be present throughout at least two menstrual cycles and dissipate within a few days of menstruation.20

**Symptom Management**
The main goal of treatment is to relieve symptoms of PMS or PMDD. The following strategies can help.

**Nonpharmacologic Options**
As a first line of treatment, lifestyle modifications are recommended for all women experiencing PMS or PMDD.1 This would include dietary changes, exercise, cognitive behavioral therapy, and complementary and alternative medicine.

**Dietary Modifications**
Sugar, alcohol, caffeine, and sodium all have been implicated to some extent in worsening PMS symptoms. Recommendations include decreasing caffeine, salt, and simple refined carbohydrates, and focusing on small frequent meals to help reduce irritability, insomnia, fluid retention, breast tenderness, bloating, and weight gain.9

Eating large amounts of salty foods may cause bloating and fluid retention,2 while excessive alcohol and caffeine consumption can worsen affective symptoms and have been associated with prolonged cramping.2

**Exercise**
Exercise has been shown to increase endorphins, improving mood and decreasing feelings of lethargy.21 While there’s insufficient evidence to substantiate exercise as a treatment for PMS, the benefits to overall health through exercise are widely documented.

**Cognitive Behavioral Therapy**
This type of therapy focuses on modifying problematic thoughts and behaviors. It may be effective for physical and emotional symptoms and has been shown to be the most effective in women suffering from severe PMS.21

**Herbal Supplements**
Vitamin and mineral deficiencies also can play a role in the development of PMS. A 2009 review examined 62 herbal supplements, vitamins, and minerals associated with PMS symptom relief. Randomized controlled trials for 10 supplements were found; the only herbal supplement with reliable data of its effectiveness was chasteberry.22 According to the review, there were inconclusive data regarding the effectiveness of evening primrose oil, ginkgo biloba, saffron, St. John’s Wort, soy, and vitamin E.
Chasteberry (Vitex agnus-castus) is a fruit of the chaste tree found mainly in central Asia and the Mediterranean. It’s believed that the extract can stimulate the pituitary gland to produce luteinizing hormone, which signals the ovaries to produce progesterone, thereby normalizing the ratio of progesterone to estrogen and relieving PMS-related symptoms such as bloating, irritability, and depression. Its effect also has been associated with that of fluoxetine, an antidepressant.\(^\text{23}\)

A randomized controlled trial of 170 women showed a 50% decrease in PMS symptoms including irritability, mood swings, anger, headache, and breast tenderness with 20 mg of chasteberry vs placebo.\(^\text{24}\)

**Pharmacologic Therapies**

Conventional therapies include NSAIDs for pain; diuretics for fluid retention; oral contraceptives to reduce breast pain, bloating, and acne; antidepressants for severe PMS and PMDD; and antianxiety medications for severe PMS-related anxiety. Pharmacologic therapies include the following:

**Antidepressants.** Selective serotonin reuptake inhibitors (SSRIs) are most commonly used to treat depression and anxiety but are becoming more widely accepted as one of the first lines of therapy for PMS. By inhibiting the absorption of serotonin they’re believed to help improve mood. Marjoribanks and colleagues conducted a review of 31 randomized controlled trials comparing the SSRI fluoxetine, paroxetine, sertraline, escitalopram, or citalopram vs placebo. The studies involved a total of 4,380 women who were clinically diagnosed with PMS. In nine of these studies, a moderate effect was found in self-reported symptoms; however, the evidence is unreliable, as several of the studies had received funding from pharmaceutical companies.\(^\text{25}\)

Besides SSRIs, tricyclic antidepressants such as clomipramine, which affects serotonin activity, may be beneficial.\(^\text{26}\)

**Anxiolytic Agents.** Some of the most severe symptoms occur in the late luteal phase when progesterone levels are declining. Anxiety is a common symptom and can be debilitating. Progesterone can have anxiolytic effects due to the actions of its metabolites at GABA receptors.\(^\text{9}\) And while at first it made sense to attempt supplementation with progesterone to ease PMS symptoms, progesterone levels are no different in women with PMS vs women without PMS, and studies haven’t shown efficacy related to this type of treatment.\(^\text{9}\) In women with persistent anxiety after trials with SSRIs, an anxiolytic agent often is added.\(^\text{21}\) Evidence is controversial; however, alprazolam and buspirone have been shown in clinical trials to be more effective than placebo in relieving depression, tension, anxiety, irritability, hostility, and social withdrawal.\(^\text{21}\)

**Diuretics.** Diuretics increase urination, which helps to eliminate water and salt and can help to reduce bloating in women with PMS. They also may have a positive effect on mood, breast tenderness, and food cravings. It’s important to note that certain diuretics deplete the body’s potassium stores, while others spare it. Individuals taking diuretics should pay close attention
to these effects as well as potential drug interactions and speak to their doctors about all medications, vitamins, and herbal supplements they may be taking.

**Hormonal Therapy**

According to a review by Rapkin, there appears to be a clear link between fluctuating hormones and PMS symptoms.\(^9\) Because of this link, suppression of ovulation has been studied as an alternative approach when SSRIs or anxiolytic agents have been ineffective.\(^9,21\)

Gonadotropin-releasing hormone (GnRH) agonists suppress ovulation and the hormonal fluctuations associated with PMS. They’re synthetic analogs of naturally occurring GnRH, which reduces the secretion of luteinizing hormone and follicle-stimulating hormone and interrupts the normal production of sex hormones.\(^27\) These agents may relieve breast tenderness, fatigue, and irritability, but have little effect on depression. The adverse effects associated with this method of treatment aren’t well tolerated by many women. In particular, decreased estrogen levels can affect bone mineral density and cause depression, headaches, and muscle aches.\(^21\) Because of the severe side effects, especially reduced bone mass, calcium and vitamin D supplementation are strongly urged and use should be limited to six to nine months without additional estrogen and progesterone supplementation.\(^21\)

Despite being widely used for PMS symptom management, oral contraceptives haven’t been consistently effective in clinical trials.\(^21\) The benefit is most likely due to their estrogen content, and more beneficial effects are seen with monophasic vs tri-phasic pills due to the lack of hormone fluctuation. Tri-phasic pills have demonstrated relief of many physical symptoms but not mood-associated symptoms, and may even exacerbate them due to the hormone fluctuations.

**The Food Connection: Nutrients That May Influence PMS**

There’s evidence that a woman’s diet may contribute to the development of PMS or be related to symptom severity. What women eat and drink, or in some cases, what they don’t eat and drink, can be directly related to PMS symptoms. Those nutrients with the biggest perceived impact to date are discussed below.

**Calcium and Vitamin D**

Higher dietary intake of both calcium and vitamin D through foods and supplements has been associated with reduced risk of PMS. These two nutrients may influence its development through their relationship to estrogen.\(^4\) Estrogen improves the absorption of calcium in the gastrointestinal tract and helps maintain calcium levels within bones. A lack of estrogen, common in menopausal women and those unable to produce adequate estrogen, such as women with anorexia or who exercise excessively, impairs calcium absorption. This impairment leads to an increase in bone resorption so the body can meet its blood calcium needs.

There are many similarities between PMS symptoms and those of hypocalcemia or hypercalcemia, including anxiety, depression, and fatigue.\(^6,28\) Studies suggest blood calcium and vitamin D levels are lower in women with PMS than in others and that calcium supplementation may reduce symptom severity.\(^2\) Thys-Jacobs found that taking 1,200 mg of
calcium per day through supplements, such as calcium carbonate, significantly decreased certain symptoms, specifically depression, mood swings, headache, and irritability. She theorized that a calcium deficiency and/or a dysregulation of calcium-associated hormones (such as estrogen) may be the primary culprits in PMS. This study found a significant decrease in negative effects, including water retention, food cravings, and pain by the third treatment cycle with calcium supplementation.

Could PMS really just be the clinical manifestation of calcium deficiency? The answer likely is more complex, but most evidence suggests calcium may be an effective dietary treatment for PMS. Based on the Thys-Jacobs study, Bertone-Johnson and colleagues aimed to test whether high calcium intake in women with no symptoms would prevent PMS from developing. When they adjusted for confounding factors, they found that calcium intake, particularly from food sources, was inversely related to PMS, with a 30% risk reduction in women with the highest calcium intakes. They found that the equivalent of 1,200 mg of calcium carbonate and approximately 400 IU daily of vitamin D from food sources may help prevent the development of PMS. Adequate amounts of vitamin D are important, too, because of its role in calcium absorption. However, it also may have its own benefits for preventing PMS.

Women experiencing PMS symptoms specifically during the luteal phase may be vitamin D deficient to some degree, or, as mentioned, experience some level of calcium dysregulation. High total vitamin D intake has been associated with a 41% lower risk of developing PMS. High vitamin D intake from food sources alone has been linked to a lower but significant 31% risk reduction. Follow-up studies have gone further and examined whether serum vitamin D levels, which are more reflective of actual vitamin D status than is dietary intake alone, are associated with PMS. Serum vitamin D levels weren’t significantly associated with outcome, but there was some significant relationship between vitamin D intake from food sources and the prevalence of PMS.

**B Vitamins**

The B vitamins play a vast role in day-to-day functioning. They’re necessary for converting carbohydrates from food to fuel for the body; they help metabolize fat and protein; are necessary to maintain healthy skin, hair, and nails; and support nervous system functioning. Vitamins B₁₂, B₆, thiamine, riboflavin, niacin, and folate are all involved in the metabolism of neurotransmitters but through different mechanisms. Riboflavin is needed to convert B₆ into its usable form, which is necessary to synthesize serotonin from tryptophan. Niacin deficiency has been linked to tryptophan depletion, which may limit its ability to be converted to serotonin. Thiamine is required for glucose metabolism but also is involved in the biosynthesis of GABA. Vitamins B₁₂ and B₆, and folate are associated with the formation of S-adenosyl-methionine and tetrahydrobiopterin, both of which are required to metabolize serotonin and dopamine.

Because of the necessity of B vitamins for proper neurotransmitter synthesis, studies have looked at their role in the incidence of PMS. One such study by Chocano-Bedoya and colleagues, published in 2011 in *The American Journal of Clinical Nutrition*, evaluated the association between intakes of dietary thiamine, riboflavin, niacin, folate, B₆, and B₁₂ and the development of PMS. A case-control study nested within the NHS II was conducted over 10 years. All participants were free of symptoms at the start of the study and completed
questionnaires three times between 1991 and 1999. The researchers found that higher intakes of dietary thiamine and riboflavin for approximately two to four years was associated with a significantly lower incidence of PMS. The amount required to see such effects, however, was significantly higher than the recommended dietary allowance (RDA). Intakes of approximately 1.9 mg/day of thiamine vs 1.2 mg/day reduced risk by 25%. The RDA for thiamine is 1.1 mg/day. Intakes of 2.5 mg/day of riboflavin vs 1.4 mg/day resulted in a 35% lower risk of developing symptoms. Of note, this study didn’t find the same effects with supplements. In fact, women taking vitamin B supplements had a higher risk of developing PMS than those not taking supplements. Researchers believe this could be related to the bioavailability of B vitamins in foods or possibly to the benefits of other nutrients also found in these foods.

**Vitamin B₆**

Vitamin B₆ is a factor in the synthesis of the amino acids tryptophan and tyrosine, the precursors to serotonin and dopamine, respectively, both of which affect mood. It’s believed that B₆ may correct a deficiency in the hypothalamic-pituitary axis. Some theories suggest low levels of vitamin B₆ may cause high levels of prolactin, producing edema and some psychological symptoms associated with PMS.

B₆ has been studied independently as a way to alleviate PMS symptoms. Contrary to the findings of Chocano-Bedoya and colleagues, who looked at the incidence of PMS, studies have shown B₆ supplementation can help alleviate symptoms in those women already experiencing PMS; however, results of studies on supplementation have been mixed. Some show a significant reduction in irritability, depression, and breast tenderness, while others observed no significant effect.

A meta-analysis of nine published trials involving almost 1,000 women with PMS found that supplementing with vitamin B₆ was more effective in reducing symptoms than was a placebo, but most of the studies analyzed were small and had methodological weaknesses, making it difficult to draw any definitive conclusions from the results.

A more recent double-blinded, randomized controlled trial in 94 women found that 80 mg of vitamin B₆ taken daily over the course of three menstrual cycles was associated with a statistically significant reduction in several symptoms including moodiness, irritability, forgetfulness, bloating, and especially anxiety. The potential effectiveness in alleviating mood-related symptoms might be due to its role in neurotransmitter synthesis.

**Iron**

Iron is involved in the synthesis of serotonin from tryptophan, as are many of the nutrients discussed here. Researchers at the University of Massachusetts Amherst evaluated the intake of certain minerals as they relate to the incidence of PMS. Similar to Bertone-Johnson’s study examining calcium intake, a case-control study was conducted nested within the NHS II. Participants were free of PMS symptoms at baseline and nutrient intake was assessed three times within a 10-year span. This study found that high intake of nonheme iron through supplements or plant sources was associated with a lower risk of PMS. Interestingly, this
benefit wasn’t observed with intakes of heme iron. And similar to the findings in other studies regarding riboflavin and thiamine intake, the level of iron intake in which an association was observed was higher (>20 mg/day) than the current RDA for women aged 20 to 40 (18 mg/day).35

**Magnesium**
Evidence suggests magnesium may be beneficial in reducing fluid retention associated with PMS. Studies of magnesium supplements have shown improvement in mood, water retention, breast tenderness, and insomnia. A study published in the *Journal of Women’s Health* by Walker and colleagues found that daily supplementation with 200 mg of magnesium oxide reduced complaints of weight gain, swelling, breast tenderness, and bloating after two months vs placebo.36 However the ACOG hasn’t recommended magnesium supplementation as a treatment for PMS.

**The Role of a Healthful Diet**
While the jury is still out on the benefits of certain nutrients related to alleviating symptoms or reducing the risk of PMS onset, it’s clear that a healthful, balanced diet is an important part of battling premenstrual syndrome. Research is showing that certain dietary nutrients should be closely examined if complaints of PMS-related symptoms exist. While diet alone likely won’t prevent PMS or cure it, it’s certainly one of the first lines of treatment.

**Foods to Include**
Clients who maintain a healthful, balanced diet most likely will achieve the recommended amounts of the important nutrients. Clients should be counseled on food sources of calcium, vitamin D, B vitamins, in particular riboflavin and thiamine, as well as magnesium and iron. Since it may be difficult to achieve recommended amounts of certain nutrients through food sources alone, such as with vitamin D and iron, supplements may be recommended to help clients achieve adequate intakes. Of particular note are the following:

- **calcium-rich foods**: dairy products, dark green leafy vegetables, nuts, grains, beans, canned salmon and sardines;
- **vitamin D-rich foods**: eel, salmon, trout, tuna, mushrooms, and eggs, or fortified foods;
- **magnesium-rich foods**: dark leafy greens, nuts, seeds, fish, beans and legumes, whole grains, avocados, and low-fat dairy;
- **riboflavin-rich foods**: fortified cereals, almonds, organ meats, whole grains, wheat germ, mushrooms, soybeans, dairy products, eggs, and dark green vegetables;
- **thiamine-rich foods**: fortified cereals, legumes, nuts, and red meat; and
- **vitamin B₆-rich foods**: meat, poultry, fatty fish, whole grains, fortified cereals, soybeans, avocados, baked potato with skin, bananas, and peanuts.

**Foods to Avoid**
It’s recommended that women decrease or eliminate intake of caffeine, sugar, salt, and alcohol, particularly during the luteal phase. All have been associated with an increase in the stress hormone cortisol and a decrease in serotonin.2 Sodium restriction is recommended to help minimize bloating, fluid retention, and breast swelling or tenderness.2 Caffeine restriction is recommended primarily due to its association with an increase in irritability, anxiety, and
insomnia, so RDs may want to advise their clients to think twice about that extra cup of coffee or tea, and definitely to steer clear of energy drinks and soda. Alcohol can exacerbate PMS symptoms and also may deplete the body’s vitamin B stores.

**Conclusion**
Women who experience chronic PMS can benefit from a consultation with an RD who can make personalized diet and lifestyle recommendations. By looking at an individual’s history, both medical and social, and performing a detailed dietary intake assessment, RDs are uniquely positioned to identify deficiencies and recommend dietary changes to improve symptoms. Taking food allergies and intolerances into account, RDs can recommend foods to include or avoid or may recommend additional vitamin and mineral supplements. RDs also are well positioned to make lifestyle recommendations, such as increasing exercise, stress management, or smoking cessation if appropriate. Offering education on the benefits of nutrients in relieving PMS symptoms can help women make optimal food choices providing the continued benefits of a healthful, balanced diet.

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**References**


Quiz

1. What is considered the first line of treatment for women who have premenstrual syndrome (PMS)?
   A. Vitamin supplementation
   B. Selective serotonin reuptake inhibitors (SSRIs)
   C. NSAIDs
   D. A combination of exercise, dietary modifications, and cognitive behavioral therapy

2. Which amino acid found in carbohydrate-rich foods is said to help improve mood?
   A. Methionine
   B. Glutamine
   C. Arginine
   D. Tryptophan

3. Which pharmacologic therapy would more immediately require adequate calcium and vitamin D supplementation?
   A. Oral contraceptives
   B. SSRIs
   C. Gonadotropin-releasing hormone agonists
   D. Diuretics

4. Higher intakes of which B vitamin have been shown to be significantly related to decreased PMS incidence?
   A. B₁₂
   B. Niacin
   C. Folate
   D. Thiamine

5. SSRIs help improve mood by which of the following actions?
   A. Suppression of ovulation
   B. Speeding the uptake of serotonin by receptors
   C. Blocking the action of serotonin
   D. Blocking the absorption of serotonin

6. During which phase of the menstrual cycle do women typically experience symptoms of PMS?
   A. Ovulation
   B. Menstrual
   C. Luteal
   D. Follicular
7. On average, what percentage of women who report premenstrual symptoms meet the clinical definition for a PMS diagnosis?
A. 80% to 90%
B. 50% to 70%
C. 8% to 20%
D. <10%

8. Which form of iron is most beneficial to help reduce PMS symptoms?
A. Heme iron
B. Nonheme iron
C. Both sources are equally beneficial
D. Supplemental iron only

9. How long should a woman keep track of her symptoms to be properly diagnosed with PMS?
A. One month
B. Six months
C. Three months
D. One year

10. How many symptoms must be present for a patient to receive a diagnosis of premenstrual dysphoric disorder?
A. Three
B. Five
C. Seven
D. 10