

# **Astaxanthin as a Possible Therapeutic Agent in Polyendocrine Metabolic Ovarian Syndrome (PMOS)**

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September 19, 2026

## **STORY AT-A-GLANCE**

- › Research suggests astaxanthin may influence several underlying drivers of polyendocrine metabolic ovarian syndrome (PMOS) at the same time, including oxidative stress, inflammation, insulin sensitivity, and hormone signaling, rather than targeting just one symptom
- › Women taking astaxanthin produced more mature eggs and higher-quality embryos during fertility treatment, suggesting it strengthens the environment surrounding developing eggs even before pregnancy outcomes begin to change
- › Research suggests astaxanthin may help protect the specialized ovarian cells that nourish developing eggs by supporting cellular stress reduction and the body's own antioxidant defenses, creating healthier conditions for normal ovarian function
- › Astaxanthin may also support metabolic health and fertility-related processes, according to research; however, it doesn't consistently promote weight loss or increase pregnancy and live birth rates, highlighting the need for larger, longer clinical studies
- › You may be able to support astaxanthin's potential benefits by improving your overall metabolic health through whole, minimally processed foods, avoiding seed oils, staying physically active, managing stress, and reducing exposure to hormone-disrupting chemicals

Polyendocrine metabolic ovarian syndrome (PMOS) — formerly known as polycystic ovary syndrome, or PCOS — is one of the most common hormone and metabolic disorders in women of reproductive age, affecting about 10% of women during their childbearing years.<sup>1</sup> You might notice irregular menstrual cycles, acne, unwanted facial or body hair, weight gain, or difficulty becoming pregnant. If left untreated, the risk for Type 2 diabetes, abnormal cholesterol levels, and cardiovascular disease also rises.

The condition was renamed in a policy paper published in *The Lancet* on May 12, 2026, backed by 56 medical organizations, patient advocacy groups, and clinical experts who collected 14,360 survey responses from patients and health professionals worldwide. Researchers found the old name "obscured diverse endocrine and metabolic features" and delayed diagnosis and care — 86% of patients and 71% of health professionals supported the change.<sup>2</sup>

The word "cyst" was dropped because many women with the condition don't develop pathological ovarian cysts; ultrasounds typically show immature follicles instead. The new name instead flags that multiple hormone systems (polyendocrine) and metabolic processes like insulin resistance, not just the ovaries, are involved.

Unlike many conditions with a single cause, PMOS develops through several interconnected problems, and that complexity helps explain why standard treatments don't work equally well for everyone. Drug-related side effects remain an ongoing concern, and lifestyle changes alone sometimes fall short.

That reality has increased interest in natural compounds that address several biological pathways at once instead of focusing on only one symptom. One compound drawing serious research attention is astaxanthin, a carotenoid pigment produced by microalgae and concentrated in the seafood that feeds on them. Research suggests it reaches beyond a single mechanism, influencing the metabolic, hormonal, and cellular environments that keep PMOS going.

# Researchers Mapped the Many Ways Astaxanthin Supports Ovarian Health

A systematic review published in *Frontiers in Reproductive Health* evaluated research on [astaxanthin](#) as a treatment strategy for PMOS. Researchers searched for human and mammalian animal studies published between January 2020 and March 2026.

They examined changes in metabolism, hormone regulation, inflammation, oxidative damage, ovulation, and fertility outcomes to determine where astaxanthin consistently produced benefits. Instead of targeting one symptom, the evidence suggested astaxanthin influences several interconnected systems involved in PMOS.

- **The body's natural antioxidant defenses became stronger** — The review found that astaxanthin activated the Nrf2 pathway, one of your body's primary defense systems against oxidative damage. This increased production of protective antioxidant enzymes. Studies also reported higher total antioxidant capacity together with lower levels of damaging reactive oxygen species inside ovarian tissue.

Rather than simply neutralizing harmful molecules itself, astaxanthin helped cells strengthen their long-term defense system.

- **Inflammation fell while communication between the brain and ovaries improved** — Researchers reported that astaxanthin lowered inflammatory messengers by suppressing the NF- $\kappa$ B inflammatory pathway.

The review also described evidence that astaxanthin crosses the blood-brain barrier and was linked in animal research to healthier communication within the hypothalamic-pituitary-ovarian axis, the hormone signaling network connecting your brain and ovaries — a finding that hasn't yet been confirmed in human studies. By calming inflammation throughout these systems, astaxanthin may help create conditions that better support normal [ovarian function](#).

- **Insulin sensitivity and hormone balance improved together** — Several studies included in the review found that astaxanthin improved glucose handling by increasing GLUT4 activity, allowing cells to move more glucose out of the bloodstream and use it for energy. GLUT4 is a transporter that acts like a door on the surface of muscle and fat cells.

Animal research summarized in the review also found that astaxanthin activated AMPK, often called cells' energy sensor because it regulates how efficiently energy is produced.

Clinical research summarized in the review found reductions in fasting insulin, HOMA-IR, body mass index, luteinizing hormone, testosterone, and anti-Müllerian hormone after three months of supplementation. Those improvements show that metabolic health and hormone balance often improve together instead of separately.

- **Healthier ovarian cells supported better egg development** — The review found that astaxanthin protected granulosa cells, the specialized cells that surround and nourish developing eggs. Researchers observed less oxidative damage, fewer cells undergoing programmed death, healthier mitochondria, and improved production of the steroid hormones these cells are designed to make.

**Mitochondria** are the energy-producing structures inside every cell, and granulosa cells depend heavily on them to fuel the months-long process of egg development. Studies also reported improvements in egg maturation, embryo development, and embryo quality together with higher antioxidant capacity inside follicular fluid, creating a healthier environment for reproduction. (These cellular and mitochondrial findings are drawn primarily from animal and cell-culture research.)

- **The greatest promise came from combining astaxanthin with broader metabolic support** — The review discussed animal research in which astaxanthin was combined with omega-3 fatty acids and metformin in a PMOS rat model, showing

additional improvements — including better endometrial receptivity and lower oxidative damage — compared to conventional treatment alone.

At the same time, the authors emphasized that larger, longer-term clinical trials are still needed because many existing studies involved relatively small groups of participants. They also noted that improving astaxanthin's stability and absorption remains an important goal for future research.

*Note: Several mechanistic findings described in this article — including effects on the Nrf2 and NF- $\kappa$ B pathways, blood-brain barrier penetration, GLUT4/AMPK activation, and the combination-therapy findings — were observed in animal or cell-culture research and may not directly translate to human outcomes. The human clinical findings discussed come from a limited number of relatively small, short-term studies; results may not apply to all individuals.*

## **Astaxanthin Improved Egg Quality Before Pregnancy Outcomes Changed**

A study published in Scientific Reports investigated whether astaxanthin could reduce endoplasmic reticulum (ER) stress in women with PMOS undergoing in vitro fertilization (IVF).<sup>3</sup> Endoplasmic reticulum stress occurs when a cell's protein-building system becomes overloaded and starts malfunctioning.

The researchers enrolled 58 women with PMOS, randomly assigning them to receive either 12 milligrams (mg) of astaxanthin or a placebo daily for 60 days. They collected granulosa cells along with follicular fluid to determine whether astaxanthin improved the environment surrounding each egg before fertilization.

- **The greatest improvements occurred inside the egg's support system** — Women receiving astaxanthin showed significant improvements in several laboratory markers linked to healthier cell function. Those biological changes occurred before noticeable differences appeared in pregnancy outcomes, suggesting that stronger ovarian cells develop before larger reproductive improvements become visible.

- **Egg quality improved even though pregnancy rates did not** — After 60 days of supplementation, women taking astaxanthin produced significantly more mature oocytes, higher-quality oocytes, and higher-quality embryos than those receiving the placebo. Oocytes are immature egg cells that need to fully mature before fertilization.

However, the total number of eggs retrieved, fertilization rates, and pregnancy-related outcomes didn't differ significantly between the two groups during the study period. These findings show that astaxanthin improved the quality of developing eggs rather than simply increasing the number of eggs produced.

- **The protective environment surrounding each egg became healthier** — Researchers also found significantly higher total antioxidant capacity inside follicular fluid, the nutrient-rich liquid surrounding each developing egg. Because eggs remain inside the ovary for months before ovulation, they depend on this fluid for nutrients and protection throughout their development.

Improving the antioxidant environment helps shield these delicate cells from ongoing damage, creating healthier conditions long before fertilization occurs. Rather than changing the egg directly, astaxanthin strengthened the environment supporting its development.

- **Several cellular stress signals became quieter while protective responses remained active** — The researchers measured multiple markers involved in the unfolded protein response, the emergency system cells activate when damaged proteins begin accumulating.

Women taking astaxanthin had much lower levels of several biological markers that indicate cells are under stress, showing their ovarian cells were healthier than those in the placebo group. Notably, results suggest astaxanthin didn't simply shut every stress pathway down. Instead, it reduced harmful stress while preserving the protective responses healthy cells still need.

- **Healthier protein production offered another explanation for stronger egg development** — Every cell constantly builds proteins that perform thousands of essential jobs. The endoplasmic reticulum serves as the cell's manufacturing and quality-control center, ensuring those proteins are assembled correctly before they are released. When that system becomes overloaded, damaged proteins accumulate and interfere with normal cell function.

Women taking astaxanthin had lower levels of several markers of this cellular stress, allowing granulosa cells to spend less energy responding to damage and more energy supporting healthy egg development. Although the study found improvements in egg maturity and embryo quality, pregnancy rates did not significantly increase during the 60-day trial.

A more recent review reached the same conclusion, noting that astaxanthin consistently improves biological markers and early reproductive outcomes, but larger, longer studies are still needed to determine whether those improvements ultimately lead to higher pregnancy and live birth rates.<sup>4</sup>

- **One of astaxanthin's biggest strengths is improving cell health** — A review published in Discover Medicine evaluated eight studies (four clinical trials and four animal studies) investigating astaxanthin for PMOS.<sup>5</sup> The researchers concluded that astaxanthin consistently improved ovarian structure, follicle development, oxidative stress, inflammation, and markers of dyslipidemia such as cholesterol balance, but found little evidence that it promotes meaningful weight loss.

They also cautioned that the current evidence remains limited because most of the human studies came from the same research group, some reused the same participants and larger independent clinical trials are still needed to establish the optimal dose and confirm the findings in broader populations.

Taken together, these studies suggest astaxanthin may support a healthier cellular environment inside the ovaries — including markers of oxidative stress, inflammation, mitochondrial function, and egg quality — but those improvements haven't yet translated

into consistently higher pregnancy or live birth rates. That gap doesn't necessarily mean astaxanthin has no effect on those outcomes; it may simply mean current studies aren't yet designed to detect one.

It likely means that ovarian cell health is one piece of a larger metabolic puzzle, and astaxanthin alone can't solve every piece at once. The practical steps below target the same biological systems the research identified — insulin signaling, mitochondrial energy production, chronic inflammation, and hormone disruption — so that astaxanthin has healthier terrain to work with.

## **Reduce the Stress That Keeps PMOS Going**

The studies in this article showed that healthier ovarian cells begin with healthier metabolism, lower inflammation, and stronger cellular defenses. Nutrients like astaxanthin may help support a healthier environment inside your cells, but they work best when you also address the metabolic and lifestyle factors that keep hormone imbalance going. Every positive change builds on the last, making it easier for your body to restore healthier communication between your gut, metabolism, and reproductive hormones.

- 1. Build your meals around antioxidant-rich whole foods** — I recommend getting antioxidants from food first because nature packages them with hundreds of other protective compounds that work together.

Colorful seafood such as wild salmon and shellfish naturally contain astaxanthin, while brightly colored fruits and vegetables supply additional antioxidants that help reduce the ongoing cellular stress described in the research. Make it a daily challenge to include at least three different naturally colorful foods on your plate each day.

- 2. Choose the same form of astaxanthin used in human research** — If you decide to supplement, I recommend selecting a product derived from the microalgae *Haematococcus pluvialis*, the natural source used in most human studies. Avoid

products made from synthetic petrochemical processes or genetically engineered yeast, since those differ from the form found naturally in foods and used in clinical research.

Most studies reporting health benefits have used between 4 and 12 mg daily, with 8 to 12 mg appearing to provide the greatest benefit for most adults.

Because astaxanthin is fat-soluble, research suggests it may be better absorbed when taken with a meal that contains healthy fat. Better yet, include natural food sources regularly, such as wild salmon, sardines, and krill oil. Krill oil also supplies naturally occurring astaxanthin together with omega-3 fats, and the astaxanthin may help protect those fragile fats from oxidation before your body uses them.

- 3. Rebuild your metabolism instead of chasing individual symptoms** – PMOS involves far more than the ovaries, with underlying hormonal and metabolic dysfunction contributing to many of the condition's symptoms and health effects.

Progress is usually seen once you begin to improve insulin sensitivity, lower chronic inflammation, and restore healthier communication between your gut, metabolism, and reproductive hormones. As those systems begin working together again, symptoms often stop moving in multiple unhealthy directions at once.

Your diet becomes one of your strongest tools. Build your meals around whole, minimally processed foods that support steady energy production instead of ultraprocessed convenience foods. If your digestion feels compromised with frequent bloating or irregular bowel movements, start with easier-to-digest carbohydrates such as fruit and white rice while your digestive system recovers.

At the same time, eliminate foods that keep inflammation active, especially restaurant meals and products made with soybean, corn, canola, sunflower, and cottonseed oils. These seed oils contain large amounts of **linoleic acid** (LA), which accumulates in your tissues and interferes with your mitochondria. When your mitochondria struggle to produce energy efficiently, hormone signaling, blood sugar regulation, and inflammation all become harder to control.

I recommend replacing seed oils with traditional fats such as grass fed butter, ghee, or tallow. This directly supports what the research found inside ovarian cells – when mitochondria produce energy more efficiently, the same improvements in hormone signaling and inflammation that astaxanthin promoted at the cellular level begin happening throughout your entire body.

- 4. Use daily movement and stress recovery to reset hormone signaling** – Your muscles become one of your most powerful metabolic tools once you start using them consistently. Every walk and every strength-training session helps your muscles absorb more glucose directly from your bloodstream, lowering the amount of insulin your pancreas needs to release. Lower insulin levels help reduce one of the major drivers behind excess androgen production and ovarian dysfunction.

The research showed that astaxanthin improved insulin sensitivity by increasing GLUT4 activity and activating AMPK inside cells. Regular movement triggers those same pathways throughout your muscle tissue, amplifying the metabolic shift astaxanthin supports at the ovarian level. If your energy feels low, keep your routine simple instead of pushing harder.

Aim for about 60 minutes of walking each day, add strength training two or three times each week and avoid sitting for long uninterrupted periods. Give your nervous system daily recovery time as well. Chronic stress keeps [cortisol](#) elevated, which disrupts communication between your brain and ovaries, worsens insulin resistance, increases cravings and interferes with restorative sleep.

Morning sunlight helps regulate your circadian rhythm and supports healthy mitochondrial energy production, while meditation, mindfulness, emotional processing, and limiting screen exposure before bed all help restore healthier hormone rhythms.

- 5. Protect yourself from everyday hormone disruptors** – Food is only part of the equation. Many women overlook environmental chemicals that behave like hormones inside the body. These compounds, called xenoestrogens, mimic

estrogen and interfere with your body's normal signaling.

The studies reviewed in this article showed that astaxanthin helped restore healthier communication within the hypothalamic-pituitary-ovarian axis, the hormone network connecting your brain and ovaries. Xenoestrogens disrupt that same signaling network from the outside, which means reducing your chemical exposure protects the hormonal improvements you're working to build from the inside. I recommend reducing those exposures wherever practical.

Store food in glass containers instead of plastic, avoid drinking from disposable plastic water bottles, avoid microwaving food in plastic, and choose natural-fiber clothing whenever possible. Personal care products and household cleaners without synthetic fragrances also reduce unnecessary chemical exposure. Every step that lowers inflammation and supports healthier hormone signaling gives your body a stronger foundation for long-term improvement.

*This article is for informational purposes only and does not constitute medical advice. Consult a qualified healthcare provider before making changes to your health regimen.*

## **FAQs About Astaxanthin for PMOS**

**Q: Can astaxanthin cure PMOS?**

**A:** No. Current research doesn't show that astaxanthin cures PMOS. Instead, it appears to support several biological processes involved in the condition, including reducing oxidative stress, calming inflammation, improving insulin sensitivity, and protecting the cells that help eggs mature. It works best as part of a broader strategy that includes improving metabolism, nutrition and lifestyle habits.

**Q: How does astaxanthin improve fertility if pregnancy rates don't always increase?**

**A:** The research suggests that astaxanthin first improves the health of the ovarian environment. Women taking it produced more mature eggs and higher-quality embryos, but these improvements didn't immediately translate into higher pregnancy rates during the short study period. Better egg quality may be an important first step, but larger and longer studies are needed to determine whether it ultimately improves live birth rates.

**Q: What dose of astaxanthin has been studied for PMOS?**

**A:** Human studies have generally used between 4 and 12 mg daily, with many reporting benefits at 8 to 12 mg. Because astaxanthin is fat-soluble, research suggests it may be absorbed more effectively when taken with a meal that contains healthy fat. Natural sources include wild Alaskan or sockeye salmon, sardines, shrimp, and krill.

**Q: Will astaxanthin help me lose weight if I have PMOS?**

**A:** Current evidence doesn't suggest that astaxanthin is an effective weight-loss supplement. While studies have found improvements in insulin resistance, cholesterol balance, and other metabolic markers, they haven't consistently shown meaningful reductions in body weight. Its primary benefits appear to come from supporting healthier cell function rather than directly affecting body fat.

**Q: What lifestyle changes work best alongside astaxanthin?**

**A:** The greatest benefits are likely to come from combining astaxanthin with habits that improve your overall metabolic health. Eating whole, minimally processed foods, avoiding seed oils, staying physically active, managing stress, supporting

healthy sleep, and reducing exposure to hormone-disrupting chemicals all help address the underlying processes that contribute to PMOS, creating a healthier environment for normal hormone signaling and ovarian function.

## Sources and References

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- <sup>1</sup> [Front Reprod Health. 2026;8:1901207](#)
- <sup>2</sup> [The Lancet, May 12, 2026](#)
- <sup>3</sup> [Sci Rep 13, 3376 \(2023\)](#)
- <sup>4</sup> [Quality in Sport. 2026;59:72810](#)
- <sup>5</sup> [Discov Med. 2024;1:54](#)