

# Polyamines: Better than Biotin & Keratin for Hair Growth?

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The beauty-from-within market (dietary supplements primarily marketed to promote healthy hair and skin) continues to grow. According to a market insight report by InsightAce Analytic<sup>1</sup>, the global beauty ingestible market size was valued at \$3.29 billion in 2021, and it is expected to reach \$8.30 billion in 2030 with a CAGR of 11%. Consistent with this is the fact that there is a plethora of evidenced-based nutraceuticals to promote young, healthy-looking skin. However, the same cannot be said of nutraceuticals for hair.

## WHAT ABOUT BIOTIN?

Arguably, the most popular nutraceutical promoted for healthy hair is the B vitamin biotin. But does it really deliver? Unfortunately, the short answer is *no*. While a deficiency of biotin may contribute to hair loss<sup>2</sup>, there is no evidence that biotin intake in healthy people who already receive sufficient biotin will have any added benefit for hair. One scientific journal stated this succinctly: “To date, there have been no clinical trials conducted to investigate the efficacy of biotin supplementation for the treatment of alopecia [hair loss] of any kind, nor has there been any randomized controlled trial to study its effect on hair quality and quantity in human subjects.”<sup>3</sup>

And just in case you’re wondering, biotin deficiency in humans is rare. According to the National Organization for Rare Disease, when it does occur it may be a result from a rare genetic deficiency in the biotinidase enzyme, which impacts one in 110,000 people.<sup>4</sup>

## WHAT ABOUT KERATIN?

Keratin is a structural fibrous protein used in vertebrates (including humans) in making up scales, nails, features, horns, claws and hooves.<sup>5 6</sup> Not surprisingly, one randomized, double-blind, placebo-controlled clinical trial<sup>7</sup> demonstrated that supplementation with 500 mg of a specific keratin hydrolysate (together with 15 mg zinc, 18 mg niacin, 1.65 mg copper, 13.68 mg pantothenic acid, 2 mg vitamin B6, and 300 mcg biotin) was able to help reduce hair shedding and support the hair cycle.<sup>8</sup> One other human clinical trial<sup>9</sup> was conducted using keratin hydrolysate, but the study did not have a control group so the results are not as meaningful.

So, what are the downsides of keratin hydrolysate? There are three primary ones. First, many retailers like Whole Foods require two randomized, controlled clinical trials on a nutraceutical if you want to make claims on your label about the efficacy of that nutraceutical. Since keratin hydrolysate only has one randomized, controlled clinical trial, that is a limitation. The second downside is the price. As of this writing, the popular brand of keratin hydrolysate will cost \$4.425 (MOQ) to include 30 servings in your product—and that doesn’t include any other ingredients, packaging or the cost of manufacturing. Third, keratin hydrolysate is derived from sheep wool, so it is not a vegan source. For some brand owners and consumers, this may be a negative attribute. Some brand owners may also consider the 500 mg dose to be a downside since that limits the amount of other nutraceuticals that can be included in a capsule, and it may also have a less than desirable impact on taste if you plan to do a powdered delivery form.

## WHAT ABOUT POLYAMINES?

Another option—and in my opinion a better one—is polyamines. Polyamines are organic compounds having two or more amino groups. Spermidine is one such polyamine which can be found in a variety of different foods<sup>10</sup>. Nutraland USA offers Miricell™, a natural, non-GMO, allergen-free, vegan friendly, rice-derived source of spermidine with other naturally occurring polyamines.

### **Polyamines mechanism of action**

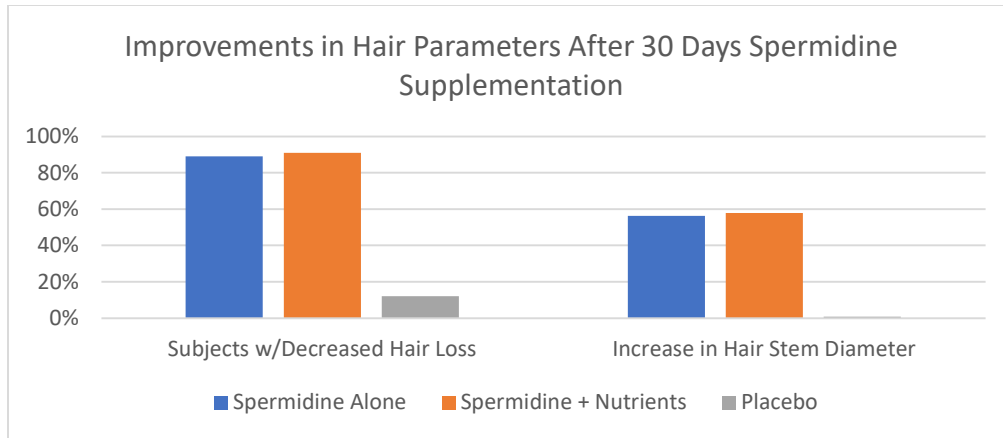
Polyamines have more than one mechanism of action. To begin with, research<sup>11</sup> clearly demonstrates that spermidine induces autophagy—the body’s process of breaking down old and damaged cell parts. This allows cells to disassemble junk parts and repurpose the salvageable components into new, usable cell parts, while discarding the unusable or unneeded parts.<sup>12</sup>

Another mechanism has to do with direct effects on hair follicles. Consider that rapidly regenerating tissues need sufficient polyamine synthesis. Since the hair follicle is a highly proliferative mini-organ, polyamines are also important for normal hair growth. This was shown in a laboratory study<sup>13</sup> using spermidine on human hair follicle epithelial stem cells. The study found that spermidine promoted hair shaft elongation and prolonged hair growth (anagen), and also upregulated expression of the epithelial stem cell associated keratins. The researchers concluded that this research provides “the first direct evidence that spermidine is a potent stimulator of human hair growth and a previously unknown modulator of human epithelial stem cell biology.” While this research was certainly interesting, the two randomized, controlled human clinical studies were even more interesting.

### **Human clinical study 1 on polyamines and hair**

A randomized, double blind, placebo controlled, clinical study<sup>14</sup> with 60 men and women (aged 18-60 years) with telogen effluvium (stress-related hair loss) demonstrated that spermidine alone (0.5 mg) or spermidine in association with other nutrients (Methionine 300 mg, Vitamin C 90 mg, Vitamin E 15 mg, Pantothenic acid 9 mg, Zinc 7.5 mg, Polyphenols from red grape peels 5 mg, Vitamin B6 2 mg, Copper 1.25 mg, Folic acid 300 mcg, Biotin 50 mcg) helped to reduce significantly the clinical symptoms and the instrumental values related to the presence of telogen effluvium. This included a reduction in hair loss, an increase in hair stem diameter, and an increase in the anagen phase (hair growth phase when the hair follicle forms a new hair shaft). Increases shown during the anagen phase are as follows:

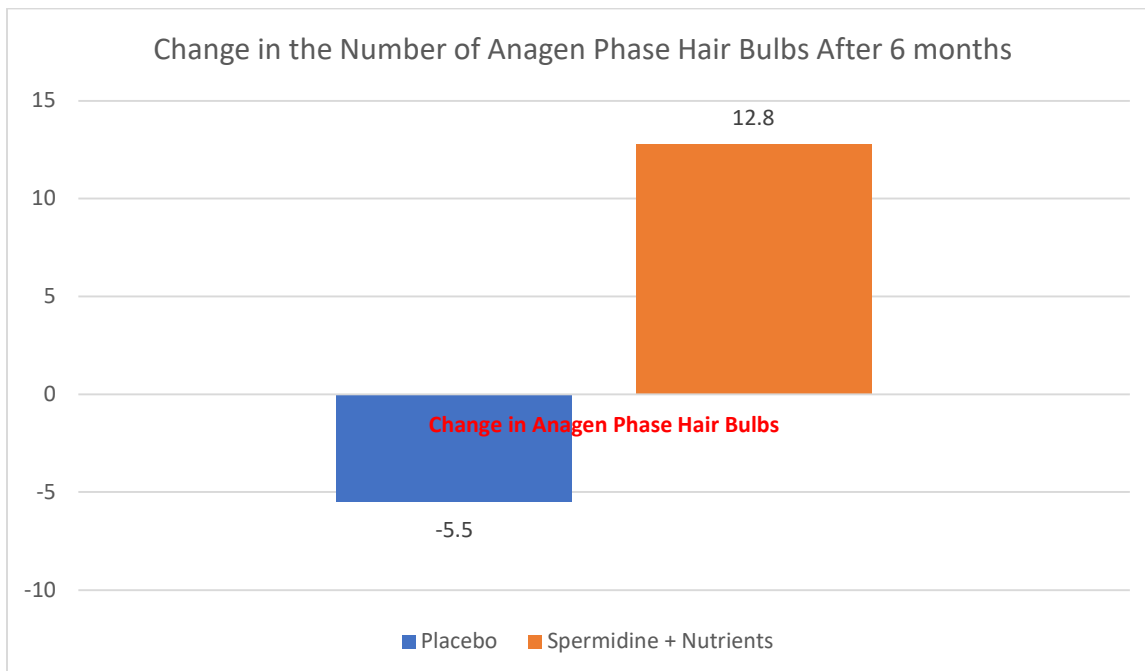
- Group A: 17.2% at T2 vs 8% at 30 days
- Group B: 20.2% at T2 vs 8.1% at 30 days
- Group C: 7.79% at T2 vs 2.7% at 30 days

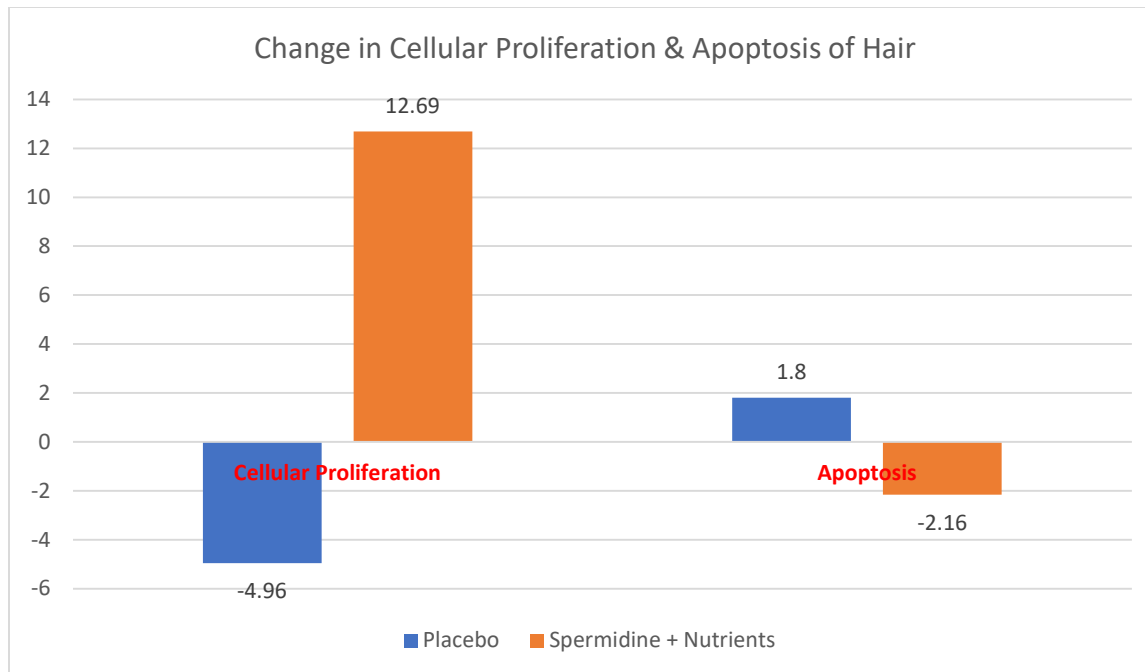


The researchers concluded that “The statistical difference resulting from the comparison of the ‘active’ and the ‘placebo’ product is highly significant, since the placebo has not produced any changes in either the clinical nor the instrumental symptoms.”

### Human clinical study 2 on polyamines and hair

Another randomized, double-blind, placebo-controlled trial<sup>15</sup> in 100 healthy men and women found that the same combination of spermidine and other nutrients increased the number of anagen hair follicles after 90 days of treatment, accompanied by increased cellular proliferation and a decrease in apoptosis (cellular death of hair)—all significantly better when compared to the placebo group ( $P < 0.0001$ ). The hair pull test showed no loss of hair after six months in all patients receiving the spermidine supplement, while 68% of the subjects in the placebo group had hair loss with the pull test.





An impressive outcome of this study is that, although the spermidine supplement was given for only 90 days, the effect was *still evident at least three months later*, as demonstrated by the negative pull test in the treatment group. The researchers concluded, “These preliminary results can serve as a proof of principle to the fact that oral spermidine can exert functional effects on human HFs [hair follicles] and further strengthen previous results that showed its effectiveness for the treatment of telogen effluvium.”

#### ADVANTAGES OF POLYAMINES OVER BIOTIN AND KERATIN

So, let’s review the advantages of polyamines over biotin and keratin. As previously stated, there is no evidence that biotin intake in healthy people who already receive sufficient biotin will have any added benefit for hair, so the advantage of polyamines over biotin is clear. As to the advantages of polyamines over keratin, consider the following:

- Studies – The spermidine polyamine has two published randomized, controlled clinical trials demonstrating efficacy for human hair—which is required by various retailers to make on-package claims. Keratin hydrolysate has one such study.
- Cost – As of this writing, the cost to include 30 servings of Miricell™ polyamines (calculated as 0.5 mg spermidine/serving) is \$0.90 (MOQ) compared to keratin hydrolysate at \$4.425 (MOQ).
- Vegan - Miricell™ polyamines is derived from rice and is fully vegan. Keratin hydrolysate is derived from sheep wool which is clearly not a vegan source.
- Dose – As a 1% material, Miricell™ polyamines only requires 50 mg of material to yield 0.5 mg spermidine. This makes it easy to fit in a capsule with other nutraceuticals, and also makes it easy to be included as part of a powdered formula without negatively impacting taste.

#### CONCLUSION

Miricell™ polyamines offers a superior option to biotin or keratin for promoting various parameters of healthy hair. This includes efficacy, number of randomized, controlled clinical studies, cost, vegan friendly status and dose size. It should be reiterated that Miricell™ polyamines are also a natural, non-GMO, allergen-free, rice-derived source of spermidine with *other naturally occurring polyamines*.

According to Oxford Healthspan, it is important to use natural polyamines rather than synthetically derived materials. The reason stated is that “While synthetic spermidine mimics the chemical structure of spermidine found in food, it does not come with the other polyamines that normally accompany spermidine in nature...”.<sup>16</sup> Oxford Healthspan further explains that the presence of these naturally occurring polyamines create a “virtuous recycling loop” which allows the body to produce more spermidine, not just the amount given in the daily dose itself. So, if you want to formulate a new supplement for healthy hair, or improve an existing hair supplement, consider the value of Miricell™ polyamines.

*Nutraland USA offers clean, plant-based and sustainable branded ingredients supported by science. Our nutraceuticals are good for you, and good for the planet. For more information about how you can use Miricell™ polyamines in your dietary supplements, contact [gene.bruno@nutrallandusa.com](mailto:gene.bruno@nutrallandusa.com); 949-988-7615.*

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