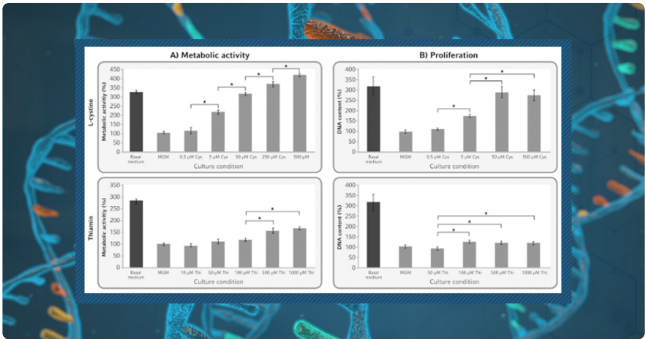


# Amino Acids To Treat Hair Loss? A Small Literature Review

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## Article Summary

Amino acids are biomolecules and the building blocks of proteins. Marketers often misappropriate petri dish, animal, and small-scale human studies to suggest that the amino acids lysine, arginine, proline, & thiamine might help treat hair loss. But is this supported by clinical studies on humans with hair loss? In some cases, yes. In many cases, no. This article reviews the science surrounding amino acids and their potential effects on human hair loss disorders.

## Full Article

Amino acids are biomolecules that are the fundamental building blocks of proteins. Proteins are essential for life, and comprise not only the structural elements of our bodies, like collagen and muscle fibers, but also enzymes and receptors that allow the chemistry of life to take place. Our bodies are able to synthesize several amino acids, but many others have to be taken in through our diet.

Our hair follicles are, unsurprisingly, completely reliant on amino acids. The keratin in our hair shafts is a type of protein after all, and the cells of our hair follicles need amino acids and protein in order to function, but are all amino acids equal? Are some amino acids particularly relevant to hair follicle health?

Many hair care products contain amino acids, and amino acid nutritional supplements are easily available, but are these worth your time and money? Here we explore whether there is any evidence to support use of amino acid supplements as a strategy for tackling hair loss with a focus on L-lysine, L-arginine, L-proline, and L-thiamine. The 'L' indicates the 'handedness' or isoform of the amino acid (amino acids exist in two mirror-image isoforms). Only 'L' amino acids are used in protein synthesis, where 'D' amino acids are not.

## What evidence exists to support amino acid supplementation for hair loss?

We performed a literature search to find out the evidence supporting amino acids for human hair growth.

## Methods

We performed a systematic search of the literature available on PubMed®. Our search queries contained the amino acid of interest along with the keyword 'hair', but excluded the word 'cochlear' due to non-relevant

research looking at inner ear hair cells (to do with hearing). We also excluded review articles, in order to narrow our search to original research papers. For example, for lysine:

We then manually went through the resulting articles to find those relevant to hair loss research – specifically, those that investigated the effects of nutritional levels of these amino acids. The results from this first pass were:

- Lysine – 214 results
- Arginine – 226 results
- Prolene – 24 results, none relevant to hair loss
- Thiamine – 29 results, 3 relevant to hair loss

For lysine and arginine, where our initial search returned significantly more results, the search criteria were further refined to look specifically for amino acids in the context of hair loss or alopecia. For example, for lysine:

The results for this more refined search regarding lysine and arginine were:

- Lysine – 33 results, 2 relevant to hair loss
- Arginine – 63 results

Since arginine appears to be included in the formulation for many different shampoos and topical hair products, we further refined our search for arginine supplements, and our search returned one relevant result.

We also searched for relevant clinical trials via ClinicalTrials.gov by searching for each amino acid in the context of 'Hair Loss'. Our search returned only two clinical trials, which were investigating thiamine.

## Results

Here's a breakdown of what we found, organized by each amino acid.

### Lysine

The only clinical data comes from a Japanese study of nearly 19 '000 patients over 7 years. Patients were diagnosed with androgenetic alopecia and were given a combined therapy, which makes it impossible to conclude the relative importance of lysine in the therapeutic regime. Patients were treated with oral finasteride as well as oral and topical minoxidil, along with a locally injected solution of lidocaine and other additives including lysine.<sup>[1]</sup> The main outcome appears to have been patient satisfaction, which was approximately 80% were 'fairly satisfied' or more at 12 months of treatment. Again, it is unfortunately impossible to discern what role, if any, lysine had to play in the treatment.

Another research paper sought to test the effects of intravenous amino acid infusions on the wool quality in sheep. However, the effects of lysine treatment were not given, so we may conclude that it had no effect.<sup>[2]</sup>

Outside of these research articles, lysine is commonly touted as beneficial for improving absorption of iron, which in turn supports hair health.<sup>[3]</sup> The links between hair loss and iron deficiency anemia may be the subject of a further review, but in any case, there appears to be little evidence for a directly beneficial effect of lysine for hair growth.

### Arginine

A study investigated the serum levels of arginine and cysteine in 30 women with chronic telogen effluvium, compared to healthy control patients. No significant correlation was found between arginine levels and hair loss, but levels of cysteine were significantly higher in patients with hair loss.<sup>[4]</sup> Based on this study, it seems unlikely that arginine supplements will assist with hair loss.

### Prolene

We could not find any research articles looking at the relationship between prolene and hair loss or hair follicle biology.

## Thiamine

The only two clinical trials we found relating to our amino acids of interest were in the context of thiamine.

One of these trials has been completed, but results have not yet been posted. It aimed to look at the effects of a dietary supplement called Alline proMEN which contains many different ingredients including vitamin B1 (thiamine).<sup>[5]</sup>

The other clinical trial (not currently open for recruitment) aims to look at the effects of a compound called BL 3000 and a supplement called Pantogar® in treating hair loss in women.<sup>[6]</sup>

Pantogar® is a nutritional supplement aimed at people suffering hair loss. Pantogar capsules contain cysteine as well as B-vitamins (including thiamine), as well as other ingredients. Taking a cursory look at Pantogar's website, we can see that it is clearly marketed towards treating telogen effluvium in women, to which they claim 'scientifically proven efficacy'.<sup>[7]</sup> We may have to take a deeper look at Pantogar itself in the near future.

Since Pantogar® contains several ingredients however, it is impossible to determine what the individual role of each ingredient is. Indeed, the same is true for Alline proMEN investigated in the other clinical trial. Usefully however, two of the research articles we turned up looked at the effects of key ingredients of Pantogar® on skin cells *in vitro* (in a petri dish, otherwise known as 'cell culture').<sup>[8] [9]</sup>

In brief, both cysteine and thiamine had a significantly beneficial effect on the growth and metabolism of skin cells *in vitro* (Figure 1).<sup>[10]</sup>

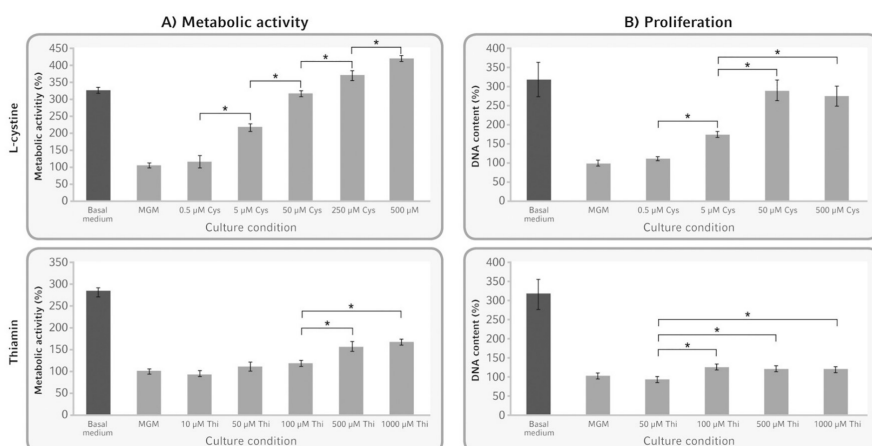


Figure 1. Impact of ingredients of the oral formulation, both separately and as the P-IC combination, on (A) metabolic activity and (B) proliferation of NHEKs cultivated for 72 h in MGM, MGM+L-cystine (Cys), thiamin (Thi). Adapted from <sup>[11]</sup>.

Finally, another research article examined the effects of two different multivitamins on treatment of hair loss in women. One of the multivitamins (given to group 2) contained thiamine nitrate. Again, due to the combined therapy, it is impossible to conclude whether any effect is due to the inclusion of thiamine. Overall the researchers report an improvement in hair loss outcomes with both multivitamins, but that group 2 (including thiamine supplement) did not perform as well as group 1 (who received a supplement composed of zinc, biotin, iron, vitamins A, C, E, and B complex, folic acid, magnesium, and amino acids of keratin and collagen)<sup>[12]</sup>.

## Are amino acid supplements safe?

By and large, amino acid supplements should be safe, provided you do not exceed the recommended daily allowance. Supplements can result in negative side effects, and certain health conditions can make you more susceptible to negative effects associated with excess levels of certain amino acids<sup>[13][14]</sup>, so always consult a medical professional before taking any new supplement.

## Are amino acid supplements for me?

If you have been diagnosed with a specific amino acid deficiency, then it is possible that amino acid supplements could help with your hair loss by supporting your overall health. However, there is very little evidence linking nutrition to hair loss such as androgenetic alopecia. Of the investigated amino acids, there

appears to be the most evidence for thiamine, although it is still unclear at this point whether thiamine is itself a useful supplement for tackling hair loss.

Since these supplements are relatively inexpensive and generally safe, if taken as recommended, then you may want to experiment with amino acid supplements. However, the evidence would suggest that is likely to be most beneficial, as mentioned, to those who have a pre-existing nutritional deficit that could be linked to their hair loss.

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