

New Science 2007- Regrow Your Hair, Starting Now

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Contents

1. **Full reprint of the 2005 study *The effects of tea polyphenolic compounds on hair loss among rodents***. from Charles R. Drew University of Medicine and Science, Los Angeles, CA
2. **New Health & Longevity** issue on the importance of this study from September 2005

Green tea polyphenols are only recently understood as positive factors in hair growth and follicle health. They possess some of the same mechanisms of action as procyanidins from apples, including:

- Inhibition of apoptosis (programmed cell death)
- Radioprotection of follicle cells
- Profound antioxidant activity
- Inhibition of 5-alpha-reductase > DHT
- Potential follicular inhibition of TGF-beta

In September 2005, we alerted our subscribers to this study as the first report of the hair growth promoting activity of polyphenols from green tea. At that time, we offered the opinion that the actions of green tea polyphenols were relevant to human hair growth, and advised our subscribers to increase their intake of polyphenols from apples, green tea, and other dietary sources dramatically. **Subsequent research has proven that GTP stimulates hair growth in human follicles.**

Key Findings

- Dietary intake of GTP is sufficient to affect hair growth in mammals
- 33% of the GTP group showed hair regrowth
- No further progression of hair loss was observed in the GTP group

For a fresh look at the new and emerging science in hair loss and hair regrowth, subscribe to the ***New Science 2007: Regrow Your Hair Starting Now*** series at www.applepoly.com/2007

The Effects of Tea Polyphenolic Compounds on Hair Loss among Rodents

Adeleh Esfandiari, DVM, PhD and A. Paul Kelly, MD
Los Angeles, California

The objective of this study was to examine the effects of polyphenolic compounds, present in noncommercially available green tea, on hair loss among rodents. In an experimental study, we randomly assigned 60 female Balb/black mice, which had developed spontaneous hair loss on the head, neck and dorsal areas into two equal groups; A (experimental) and B (control). Group A received 50% fraction of polyphenol extract from dehydrated green tea in their drinking water for six months. Group B received regular drinking water. Both groups were fed regular rodent diets (Purina Rodent Chow 5001) and housed individually in polycarbonate cages. The results showed that 33% of the mice in experimental Group A, who received polyphenol extract in their drinking water, had significant hair regrowth during six months of treatment ($p=0.014$). No hair growth was observed among mice in the control group, which received regular water.

Key words: hair loss ■ alopecia ■ green tea ■ polyphenolic compounds

INTRODUCTION

Hair loss is a common and distressing problem among human and other mammals. Hair loss in rodents is reported to occur spontaneously resembling human alopecia^{6,13} or due to overgrooming behavior,^{8,9,15} androgens¹⁹⁻²¹ or skin inflammation associated with hair loss and insufficient husbandry.^{5,18} Overgrooming or barbering in rodents occurs as a result of overcrowding.^{7,18} However, if the mice are separated into individually occupied cages, their hair will regrow. There are several reports using different regimens for treatment of hair loss. Freischmit and colleagues^{1,6} reported successful treatment of alopecia-like hair loss with contact sensitizes squaric acid dibutylester among mice.

There are several reports about the anti-inflammatory and skin cancer preventive effects of polyphenolic compound found in green tea.^{4,10,17} In several studies using mice, the anti-inflammatory and skin cancer preventative effects of green tea were found to be due to its polyphenolic constituents. These components have been shown to modulate biochemical pathways important in inflammatory responses, cell proliferation and responses of tumor promoters. Several parameters, such as NK cell activity, antibody-dependent cellular cytotoxicity, induction of specific antibody and T- and B-cell proliferation, have been used to evaluate the immuno-stimulating activity of polyphenols and green tea.⁴

The polyphenolic compositions in green tea are related to flavanols, commonly known as catechins. It has been reported that flavonoids significantly enhanced lymphocyte proliferation and caused a significant recovery of IL2 production and an increase in lymphocyte proliferation and NK cell activity in mice.⁵

Katiyar and colleagues¹¹ reported that the oral consumption of polyphenolic fraction isolated from green tea in mouse models affords protection against inflammation, chemical carcinogens and photocarcinogenesis.⁴ For example, oral feeding of green tea to Balb/c (color code for albino) mice resulted in significant protection against skin tumors.^{17,23} There are also reports on the protective effect of green tea against erythema, edema and hyperplastic epithelial

© 2005. From Department of Otolaryngology (Esfandiari, professor; director of biological research), Charles R. Drew University of Medicine and Science (Tran) and the Division of Dermatology, King Drew Medical Center (Kelley, professor of internal medicine, chief). Send correspondence and reprint requests for *J Natl Med Assoc.* 2005;97:1165-1169 to: Adeleh Esfandiari, DVM, PhD, International Health and Tropical Medicine, 1731 E. 120th St., Los Angeles, CA 90059; phone: (323) 563-5986; fax: (323) 563-5940; e-mail: adesfand@cdrewu.edu

responses of skin in mice.^{10,12}

Although there are abundant reports demonstrating the evidence regarding the anticarcinogenic properties of tea polyphenols, there are no reports of their effectiveness on hair loss. In this study, we decided to examine the effectiveness of tea polyphenols on hair loss in mice.

MATERIALS AND METHODS

Animals

Female Balb/black mice were purchased from Harlan Sprague Dawley Laboratories for a drug trial experiment. After the project was completed, the mice that served as controls were kept in our facility for student training projects. These mice were free of any infections. Among these mice, 60 were noticed to have developed spontaneous hair loss at the age of six months. These mice were individually housed, fed Purina Chow 5001 diet and kept on a 12-hour light/12-hour dark cycle. In order to rule out the possibility that hair regrowth was due to spontaneous remission, we selected mice with identical hair loss and randomly assigned them into two groups. Group A received polyphenol extracts of green tea in their drinking water, while group B received only regular drinking water. To control for possible drinking differences, mice from both groups were monthly noted for changes in weight.

Preparation of the Polyphenol Fractions from the Green Tea

Noncommercially available, dry green tea leaves (100 g) were extracted with 300 ml of 50% methanol at 50° C for three hours. The solution was filtered and the solvent removed under a vacuum rotary evaporator. After final extractions, the dried extract weighed 10.5 g and was dissolved in 500 ml sterile water.

Measurement of Hair Loss and Regrowth

The extent of hair loss was measured by marking the area of bare skin with permanent ink (mm²) using a transparent grid. The hair regrowth was quantified by computing the difference in bare skin

areas before (marked area) and after treatment.

STATISTICAL ANALYSIS

Slope of linear regression was calculated between time and rate of hair growth in treatment and control groups, respectively, and the Student's t test was used for significant changes of hair growth on the surface of the skin among groups under trial. Statistical significance was considered at $p < 0.05$.

RESULTS

Thirty-three percent of the mice who received green tea extract in their drinking water developed hair regrowth within a period of six months with an average surface regrowth rate of 1.6 mm² per month (Table 1 and Figures 2a, 2b). Statistical analysis showed that group A had a significant increase in hair growth compared to group B, who received no green tea extract in their drinking water ($p = 0.014$).

Histopathological analysis of the treated group showed progressive follicular growth. (Figures 3a, 3b, 4a, 4b). We did not observe any spontaneous remission or hair regrowth among the controls. Moreover, 8% of the control rodents showed progressive hair loss during our study, whereas **none of the mice who received polyphenoline extract derived from the tea showed any progressive hair loss.** The control rodents developed secondary infections resultant of their extensive, progressive hair loss. During the six months, there were no significant differences in weight gain or loss in either study group.

DISCUSSION

The etiology of hair loss is not well understood. Hair growth is cyclic, with phases of growth (anagen), involution (catagen) and rest (telogen).¹⁴ The cycles of active growth and rest are regulated by complex messages between the epithelium and the dermis that are not yet well understood.¹⁶ Hair follicles can become larger or smaller under systemic and local influences that alter the duration of anagen and the volume of the hair matrix.^{14,16}

A wide range of peptides, transmitters and hormones, such as corticotrophin-releasing hormone, sub-

Table 1. Mean + SE hair growth changes on the surface area of skin following treatment with green tea in mice

Group	Initial Hair Loss Surface	Hair Growth Surface	
		Difference in Six Months	Difference in 12 Months
Green Tea (n= 30)	1.61 + 0.096	-0.53 + 0.062	-0.79 + 0.093
Control (n=30)	1.58 + 0.074	0.09 + 0.025	0.16 + 0.036
Statistical Significance	NS	$p < 0.05$	$p < 0.05$

n: number of mice; NS: nonsignificant; S: significant

stance P (SP), ACTH, b-endorphin, prolactin, progesterone and catecholamine, mediate and modulate systemic stress responses. Animals individually housed have been shown to undergo a stress response due to their isolation.³ It has been shown that these stress factors can alter hair growth in mice.²

It is reported that mice with symptoms of alopecia areata, when treated with squaric acid dibutylester, showed overt hair regrowth. Histopathological examination of these animals revealed a change in the distribution of the inflammatory infiltrate of perifollicular lymphocytes around the mid and lower region of hair follicles.^{6,13,22}

In our study, we observed

Figure 1. The effect of polyphenolic extracts on hair loss

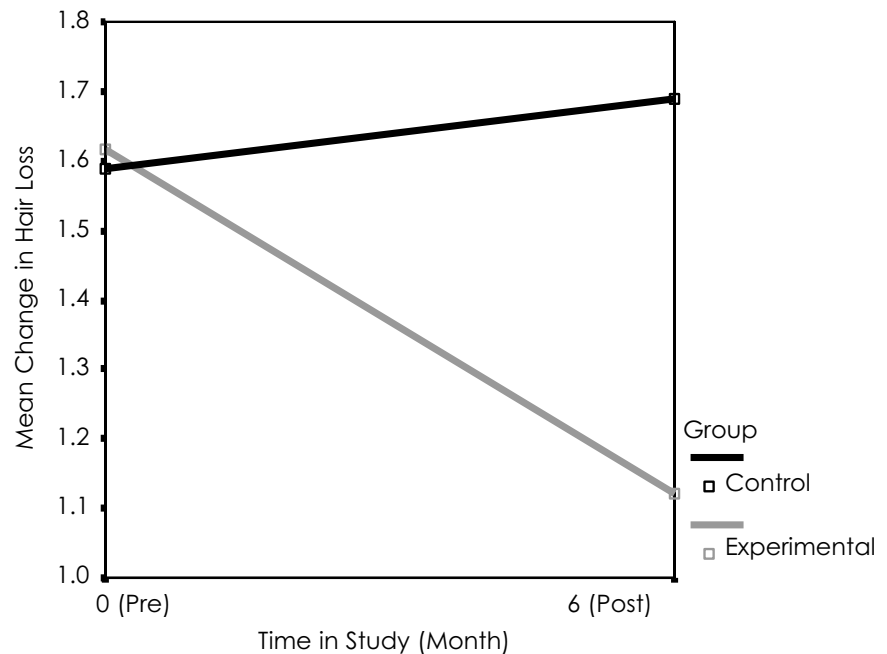


Figure 2a. Area with hair loss before treatment

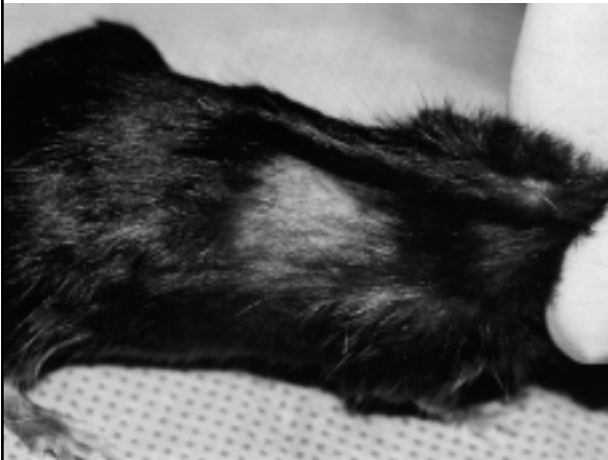


Figure 2b. Area with hair regrowth after treatment

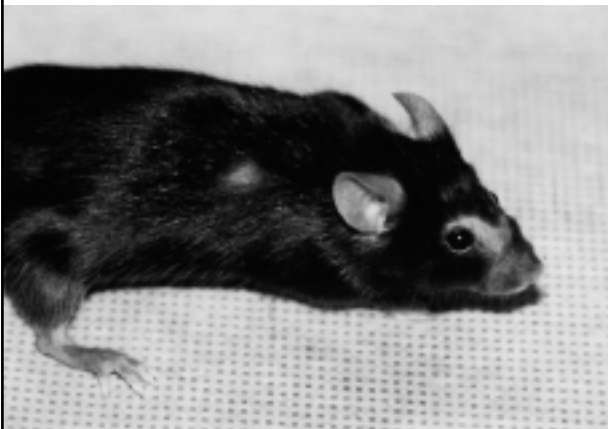


Figure 3a. Skin biopsy from hair loss area before treatment

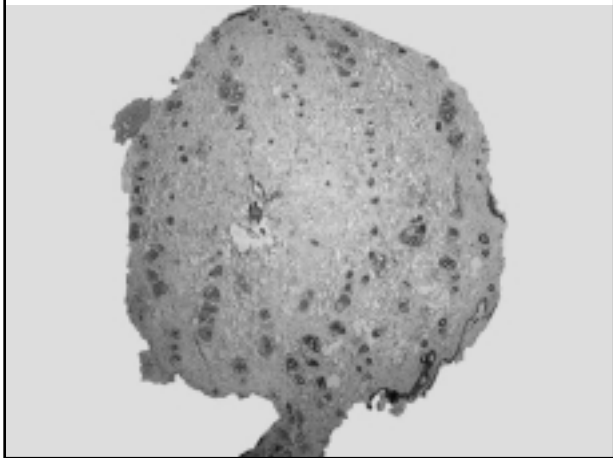
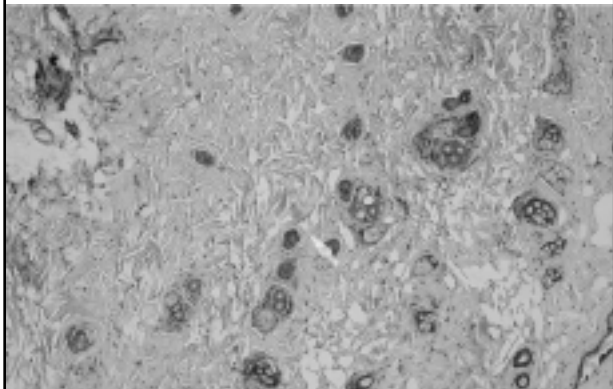


Figure 3b. Histopathology of skin with hair loss (arrow shows no follicular activity)



spontaneous hair loss on the ventral and dorsal areas of 60% of the disease-free Balb/black female mice at the age of six months. Group A received polyphenoline extract from green tea in their drinking water and group B received regular water to serve as controls. Both groups were kept in identical environmental conditions (i.e., housed individually and were fed the same diet). There were no significant differences in weight gain or loss in either group. We observed hair regrowth among 33% of the mice that received green tea extract and did not observe any spontaneous remission or hair regrowth among the controls. Eight percent of these controls showed progressive hair loss during the period of our study, whereas none of the mice who received polyphenoline extract showed any progressive hair loss.

There is abundant evidence that polyphenolic substances are considered as anti-inflammatory and have

stress inhibitory characteristics, and there is evidence that stress inhibits hair growth. However, there are no previous reports of the effects of tea polyphenols on hair loss. We feel that the findings of this study are unique and, due to limited reports on tea polyphenols and hair loss, the referencing in this study was limited to older texts and manuscripts. In this study, we attempted to measure the effects of polyphenoline on hair loss rather than identify the etiology of hair loss.

We conclude that anti-inflammatory and stress inhibitory effects of these natural substances may influence hair regrowth among mice. Further studies are in progress to explore the mechanisms and factors involved in hair regrowth in association with the polyphenols in green tea.

ACKNOWLEDGEMENTS

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Figure 4a. Histopathology of mice skin biopsy (arrow shows hair follicle regrowth after treatment with polyphenolines)

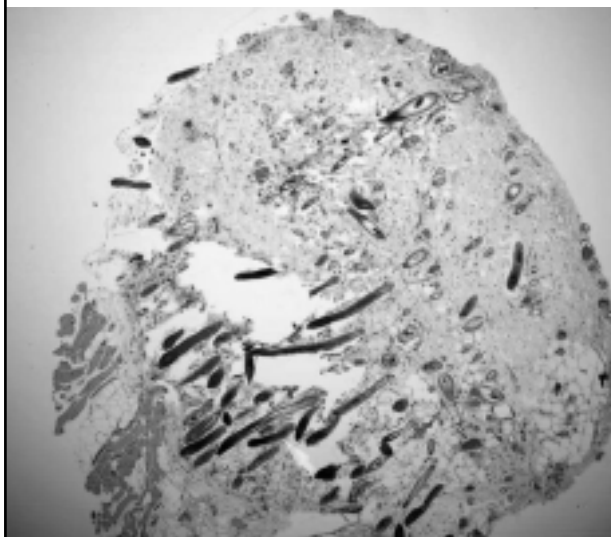
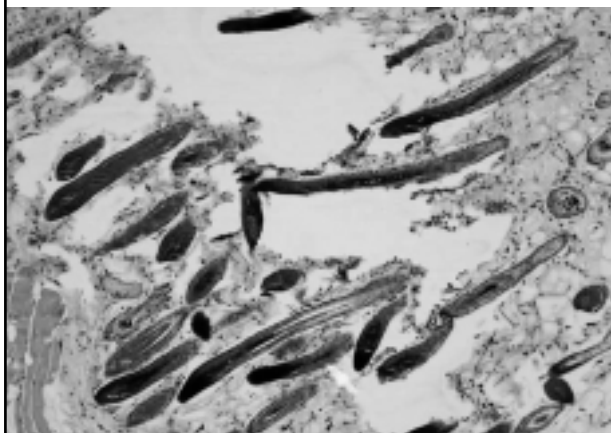


Figure 4b. Microscopic section of the hair follicular activity after treatment with polyphenolines



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Study Confirms Hair Growth Effects of Polyphenols

Los Angeles, CA— The search for a true hair vitamin has puzzled scientists for years. Now, doctors in California have identified a vitamin-like substance that looks like the natural solution to balding and unwanted hair loss.

Stunning Results in "Leftover" Mice

Doctors at Charles R. Drew University of Medicine and Science in Los Angeles had some mice left over from drug experi-

ments. Some of the animals had excessive hair loss, but were otherwise healthy. They decided to see if they could regrow hair in the mice, by adding a natural extract- known as polyphenols- to their diet.

Hair Loss "Stopped Completely"

The doctors divided the mice



A. Paul Kelly, M.D.,
Charles R. Drew
University

into two groups. They gave the first group a polyphenol extract added to their drinking water. The other group received plain water only.

After six months, the mice receiving the polyphenols in their drinking water showed no progressive hair loss.

This finding is remarkable and bears repeating. In every one of the mice fed the extract in their water, hair loss completely stopped.

"Significant" Hair Regrowth

The findings on hair loss cessation are exciting by themselves. But the real surprise is the report of "significant regrowth" of hair in animals receiving the polyphenol treatment.

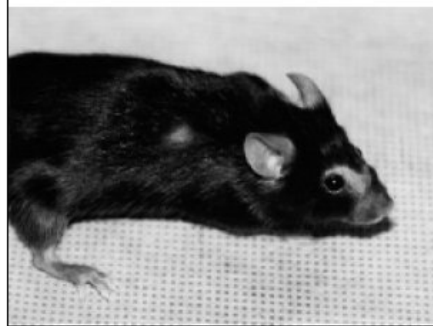
The L.A. scientists found that 33% of the treated mice had significant hair regrowth. They actually referred to this as "spontaneous remission," a medical term usually reserved for unexplainable or miraculous reversal of disease.

No hair regrowth was observed in the untreated (control) group. Other than the polyphenols, both groups were fed the same diet. Both were housed in the same conditions. Only the polyphenol group had no further hair loss, and substantial hair regrowth.

Figure 2a. Area with hair loss before treatment



Figure 2b. Area with hair regrowth after treatment



33% of mice given polyphenol extract showed significant hair regrowth. Hair loss "completely stopped" in polyphenol treated mice.

Polyphenols "More Important" than Vitamins C, E

Washington, DC— Pennsylvania researchers now believe that plant polyphenols may be "more important than vitamins C and E when it comes to preventing disease."

Joe Vinson, Ph.D., a research scientist at Scranton University in Pennsylvania, advocates increased consumption of polyphenols, due to increasing evidence of their antioxidant and health benefits.

"We think that (these) antioxidants can be good for you in a number of ways," said Dr. Vinson in a telephone interview, including affecting enzymes and genes.

Vinson and his colleagues are studying polyphenols in a variety of fruits, vegetables, spices and beverages. Their recent findings were presented at the annual meeting of the American Chemical So-

Study Confirms Hair Growth Effects (Continued)

Previous experiments have proven that polyphenols from apple skins, grape seeds and barley all exhibit the ability to regrow hair in animal and human trials. This is the first report in the literature showing that green tea polyphenols also have some hair growth effects.

The California study is also important because it's the first time that dietary polyphenols have been shown to produce new

hair growth.

Strongest Science on Apple Polyphenols

Human clinical trials on apple polyphenols, specifically procyanidins, have shown the best and fastest results in hair regrowth, but have only been tested topically. This latest study is proof that polyphenols, taken orally, have significant hair growth effects in mammals.

ciety in August.

Coffee: America's Favorite Vegetable

Dr. Vinson says that for most Americans, coffee is the number one source of antioxidants in the diet- not because it is especially high in antioxidants, but because Americans drink so much of it.

"Unfortunately, consumers are still not eating enough fruits and vegetables, which are better for you from an overall nutritional point of view," Vinson stressed.

Vitamin P?

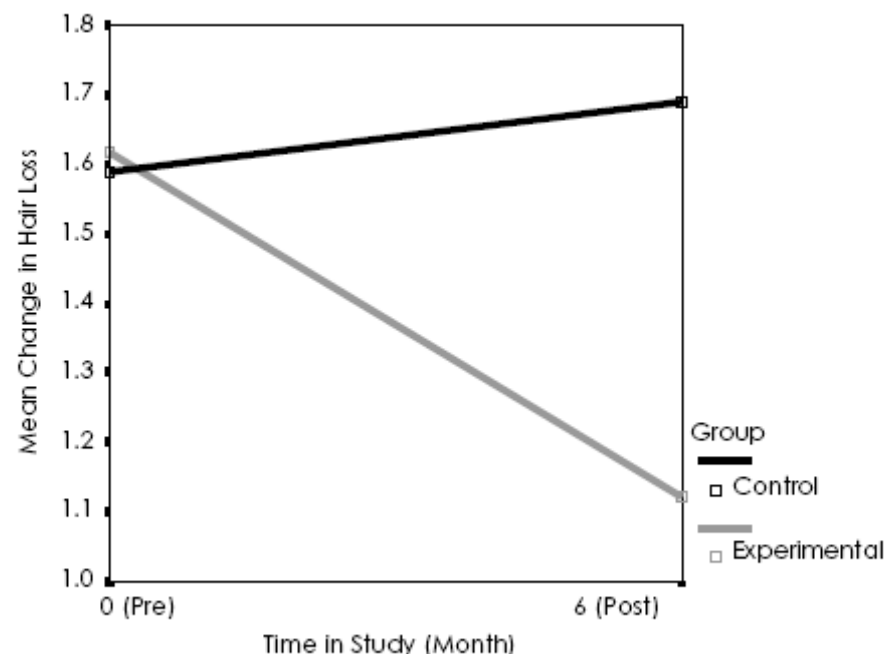
Polyphenols in tea, berries, grapes, apples, cocoa, and other foods have been the subject of hundreds of studies in the past ten years, and the favorable health benefits keep accumulating month after month.

Some researchers are now suggesting that since polyphenols offer protection against such a broad range of disease, Americans may actually be seriously deficient in polyphenols and antioxidants.

Researchers at the USDA recommend daily consumption of 2,500 to 3,500 antioxidant (ORAC) units per day for optimal health. Yet most Americans, they report, consume less than 1,200 ORAC units a day- the amount of antioxidants in one cup of spinach.

Vinson JA et al. Polyphenols: total amounts in foods and beverages and U.S. per capital consumption. Presented at the American Chemical Society 230th National Meeting in Washington, D.C. August 28, 2005.

Figure 1. The effect of polyphenolic extracts on hair loss



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The human hair cycle is a complex process. Other vitamins, minerals and hormones are certainly involved in the health of hair follicles, skin, and other organs. But now, for the first time, you can specifically target hair loss and regrowth with polyphenols- the new hair vitamin.

Esfandiari A, Kelley P., The effects of tea polyphenolic compounds on hair loss among rodents. J Natl Med Assoc. 2005 Jun;97(6):816-8.