Current Science on the Hair Growth Promoting Effects of Procyanidins: a review of the medical literature in 2007

In 1999, a group of scientists at Tsukuba Research Laboratories in Ibaraki, Japan published the first studies showing hair growth promoting effects of procyanidin chemicals extracted from apples. Since these first reports were published, multiple studies in cells, animals and human clinical trials have confirmed the effectiveness of procyanidins to intensely and safely promote hair growth.

Herein we review the available published literature, with emphasis on both results of these inquiries, and the current understanding of the mechanisms by which procyanidins promote hair growth and follicle production.

**EXCERPT:** “We report here that procyanidin oligomers possess selective and intensive growth-promoting activity with respect to hair epithelial cells in vitro and stimulate anagen induction in vivo.”

**RESULTS:** “Procyanidin dimer and trimer selectively and intensively promote growth of hair epithelial cells.”

**Highlights of this study:**

- The first published report of the hair growth effects of procyanidin compounds from apples
- Hair growth activity shown in both test tube (in vitro) and animals (in vivo)
- Describes “significant hair regeneration” in vivo
- Procyanidins twice as effective as minoxidil in vitro
- Procyanidins shown as effective as minoxidil in anagen induction in vivo

“Procyanidin oligomers... induce anagen phase efficiently in hair cycle progression in the murine model to the same degree as minoxidil.”

Procyanidin-rich apple hair growth formulas are available now at [http://www.applepoly.com/pb](http://www.applepoly.com/pb)
In this assay system, minoxidil gave a positive response. After a 19 d application of 1% minoxidil-containing agent, about 80% (81.2% ± 10.5%, average ± SD) of the shaven area was covered with hair. The control group to which vehicle was applied, on the other hand, showed little hair growth: only about 40% (41.7% ± 16.3%) of the shaven area was covered with hair on day 19. The groups to which 1% procyanidin oligomers had been applied showed an extensive growth area [procyanidin B-2, 69.6% ± 21.8% (average ± SD); procyanidin B-3, 80.9% ± 13.0%; procyanidin C-1, 78.3% ± 7.6%] on day 19 (Fig. 9).

These results demonstrate that procyanidin oligomers, such as procyanidin B-2, procyanidin B-3, or procyanidin C-1, possess marked hair-growing activity to induce anagen phase in vivo. On the other hand, neither (+)-catechin nor (-)-epicatechin, a flavan-3-ol unit of procyanidins, stimulated anagen induction in vivo (data not shown).

**DISCUSSION**

**Proanthocyanidins** Proanthocyanidins have been used as medications aimed at protecting the capillary vessels (Dartenuc et al, 1980), as cosmetics to protect the skin (Wayne et al, 1996), and as antioxidants in foods and beverages; however, there has been very little information gathered on the correlation between their degree of polymerization and properties. Barnard et al (1993) report that proanthocyanidin polymers possess anti-viral activities against the herpes virus. Ariga et al (1988) report that its anti-oxidant properties increase in proportion to the degree of polymerization. The profile of the proanthocyanidins from grape seeds in which we first discovered their hair-growing activity is as follows: the constitutive monomers were catechin and epicatechin, the degree of polymerization was 3.5, and the galloylation rate was 25% at the molar ratio per constitutive flavan-3-ol unit (Takahashi et al, 1998). Here, we investigated which proanthocyanidin molecules possess the highest hair-growing activity. It was revealed that among the monomer, dimer, and trimer of procyanidins, procyanidin dimer possesses the highest growth-promoting activity. The order of optimum concentration showing the maximum proliferative activity was trimer < dimer < monomer. In in vivo hair-growing activity to induce anagen phase, the intensity of dimers and trimers was almost equal; however, neither (-)-epicatechin nor (+)-catechin, monomers of proanthocyanidins, stimulated anagen induction. In in vitro and in vivo assays, we could find no difference between dimeric isomers composed of different monomers: procyanidin B-1, procyanidin B-2, and procyanidin B-3. The excision of gallate using tannase from proanthocyanidins purified from grape seeds raises the activity in vitro and in vivo (data not shown). Our in vivo studies led to the discovery of no other active flavonoid compounds. The procyanidin compounds we examined were built only of flavan-3-ol, so hair-growing activity may be associated with this structure.