

# The oral intake of specific Bioactive Collagen Peptides has a positive effect on hair thickness

## Abstract

The effectiveness of supplementation with Bioactive Collagen Peptides (BCP) on the health and appearance of the skin and nails has been proven in several clinical trials. The influence of BCP supplementation on hair, however, has not been investigated to the same extent.

In this placebo-controlled study, therefore, the effects of BCP intake on hair thickness and metabolism were investigated. The study was conducted on 44 healthy women aged between 39 and 75, who each received a daily dosage of 2.5 g BCP or placebo. After a treatment period of 16 weeks, hair thickness was determined and compared with the thickness at the beginning of the trial. In addition, the proliferation rate of human hair follicle cells that had been exposed to BCP was examined and the results compared with untreated control cells.

The data showed a statistically significant ( $p < 0.01$ ) increase in the cell proliferation rate of 31% compared to the controls.

The measurement of hair thickness showed a statistically significant ( $p < 0.01$ ) increase in the BCP group compared to placebo.

Over the course of the collagen peptide treatment, hair thickness increased significantly by  $1.93 \pm 0.42 \mu\text{m}$  ( $p < 0.01$ ), whereas a slight decrease in hair thickness of  $-0.99 \pm 0.40 \mu\text{m}$  ( $p = 0.07$ ) was measured in the placebo group. This clearly demonstrates the positive effect of BCP treatment on hair thickness and follicle cell proliferation.

Steffen Oesser

Collagen Research Institute, Kiel  
Germany

Corresponding author:  
Steffen Oesser  
Steffen.Oesser@cri-mail.org  
Telephone: +494315606610  
Fax: +494315606613

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## Introduction

In recent years, an increasing number of studies have demonstrated that oral supplementation with collagen-derived peptides has a positive influence on skin health and appearance. For example, it has been shown that the intake of specific Bioactive Collagen Peptides (BCP) improves the firmness and elasticity of skin, and helps to reduce the formation of wrinkles [1,2]. BCP supplementation has a direct effect on cell metabolism and leads to increased production of extracellular matrix molecules, such as collagen, proteoglycans and elastin [2]. Furthermore, it has been demonstrated that BCP intake increases nail growth and improves brittle nails in conjunction with a notable decrease in the frequency of broken nails [3]. However, the question of whether collagen peptides can have a positive effect on hair health has not been investigated to the same extent.

A number of previous studies have reported that the topical application of collagen-rich products may have an influence on hair [4-6]. A more recent trial supports the idea that collagen supplementation positively affects hair dryness and dullness [7]. Although it is also known from anecdotal evidence that the intake of collagen-rich food may have an influence on the thickness and growth of hair, current scientific studies are lacking.

The aim of this placebo-controlled study was therefore to investigate the effect of orally administered BCP on hair metabolism and hair thickness.

## Materials and methods

### Test products

Specific BCP were used for the trial. The product tested was derived from a specialized procedure by the enzymatic degradation of

collagen. It has a strong safety profile and is commercially available under the brand name VERISOL® (GELITA AG, Eberbach, Germany). Maltodextrin, provided by Cargill, Haubourdin, France, was used as a placebo.

### Study design

44 healthy women aged between 39 and 75 were included in the clinical component of the study. They each received a daily dosage of 2.5 g BCP or placebo in a sachet over 16 weeks. The powder was to be dissolved in water or any other cold liquid except milk. The products were taken orally by the subjects at home in accordance with the investigator's instructions. The subjects' compliance and tolerance of the products were checked after 1, 4, 8, 12 and 16 weeks of treatment. Hair diameter was measured (t2) after daily intake for 16 weeks by the deliberate removal of 20 hairs from the scalp. Since human hair varies in diameter, the same hair was used to evaluate the changes in hair thickness over the study period of 16 weeks. The diameter approximately 4.5 cm above the hair root corresponded to pre-supplementation thickness (t0), while the diameter 0.5 cm above the hair root corresponded to hair thickness after 16 weeks of treatment (t2). The study was approved by the International Ethics Committee of Freiburg, Germany.

All participants received detailed information on the study and gave signed informed consent. In addition to the clinical study, cell culture experiments on primary human follicle dermal papilla cells were performed to investigate the impact of BCP supplementation on hair follicle cell proliferation. The cells were cultivated in a specific follicle cell growth medium (#C-26501, PromoCell) supplemented with 10% FCS, 20 U/ml penicillin-streptomycin and 50 µg/ml partricin. After the cells had reached a confluence of 80%, the regular medium was replaced with a culture medium that was supplemented with 0.5 mg/ml BCP.

In a control experiment, no collagen peptides were added to the cell cultures.

After 4 hours of incubation in the BCP-enriched medium, the proliferation rate of the cells was determined using the Fluorometric Cell Viability Kit I (Resazurin). In brief, cell proliferation was detected by converting resazurin, a non-toxic, cell-permeable, non-fluorescent blue dye to the highly fluorescent red dye, resorufin.

Resazurin is chemically reduced by cell growth-related metabolism and enriched as resorufin in the cell culture medium. The resorufin content was detected by measuring fluorescence with excitation wavelength filters between 530–570 nm and emission filters between 580–620 nm. The results were determined in relation to the untreated control experiments and expressed as x-fold of control.

## Statistical analysis

All data are presented as the mean + standard error (SE). SPSS (IBM SPSS Statistics for Windows, Version 25.0, Armonk, NY: IBM Corp.) was used for all statistical analyses. Since the variable data from all groups showed no normal distribution according to the Kolmogorov-Smirnov (KS) test, the Mann-Whitney U test was performed to identify statistically significant differences between the groups with respect to changes in hair thickness [ $\mu\text{m}$ ].

The significance of changes in hair thickness [ $\mu\text{m}$ ] during the intervention period within the groups was analyzed using the Wilcoxon test. All tests in the descriptive analysis were performed as two-sided tests, and the significance level was set at  $\alpha = 0.05$ . The rate of cell proliferation was evaluated by ANOVA.

## Results

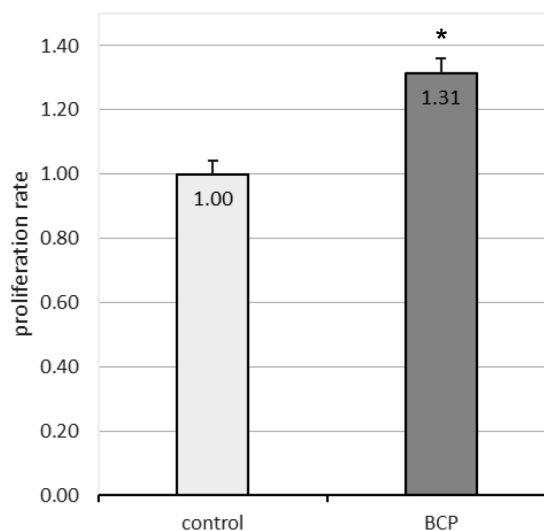
### Subjects and dropouts

A total of 44 women who fulfilled the inclusion criteria were randomized to 1 of

the study groups. All complied with the study protocol and no adverse events or unintended side effects were reported by participants from either group. On average, the subjects were  $55.3 \pm 10.1$  years old, and there were no statistically significant differences between the treatment group and the placebo group.

### Hair cell proliferation

The *in vitro* tests on human hair follicle cells showed a pronounced, statistically significant ( $p < 0.01$ ) increase in the proliferation rate of BCP-treated cells compared to untreated control cells (Fig. 1). After a 4-hour incubation period with BCP, the proliferation rate was on average 31% higher than in the untreated cells.



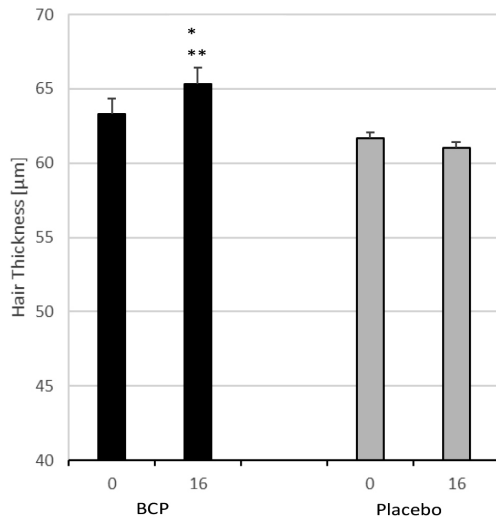
**Figure 1** Proliferation rate of human hair follicle cells after a 4-hour incubation with 0.5 mg/ml BCP in comparison to untreated controls. Data represent the mean + SE for  $n = 48$ . \* $p < 0.01$

### Hair thickness

At the beginning of the experiment, no statistically significant differences in the hair thickness of the participants were observed. Women in the placebo group had an average hair diameter of  $61.7 \pm 0.4 \mu\text{m}$  at the beginning of the observation period, while the participants assigned to the BCP treatment group had a hair thickness of  $63.3 \pm 1.1 \mu\text{m}$ .

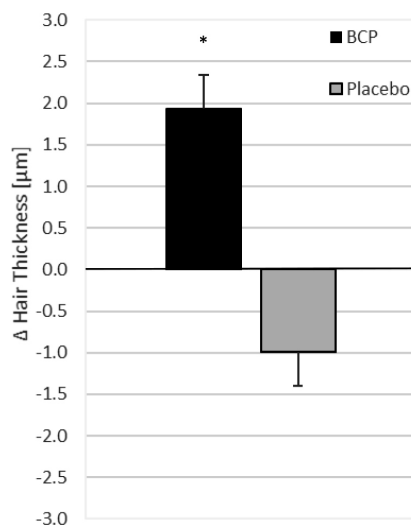
Over the course of the 16-week treatment,

hair thickness increased significantly ( $p<0.01$ ) in the participants receiving a daily dosage of 2.5 g BCP. In contrast, a slight decrease in average hair diameter was detected in the placebo group. The observed effect was not, however, statistically significant (Fig. 2).



**Figure 2** Hair thickness in healthy women before and after the 16-week oral supplementation with specific Bioactive Collagen Peptides or placebo. Data represent the mean + SE for  $n = 22$ . \* $p<0.01$ , BCP 0 weeks vs. 16 weeks; \*\* $p<0.01$ , BCP vs. placebo after 16 weeks

A comparison of the groups with regard to changes in hair thickness during the observation period revealed a statistically significant ( $p<0.01$ ) difference between the BCP-treated group and the placebo group (Fig. 3).



**Figure 3** Changes in hair thickness after BCP treatment compared with placebo. Data represent the mean + SE for  $n = 22$ . \* $p<0.01$

While hair thickness increased in the BCP group by  $1.93 \pm 0.42 \mu\text{m}$  ( $p<0.01$ ), a slight decrease in hair thickness of  $-0.99 \pm 0.40 \mu\text{m}$  ( $p=0.07$ ) was measured in the placebo group.

## Conclusions

As shown in this randomized, placebo-controlled study with female subjects aged between 39 and 75 years, the oral administration of specific BCP led to a statistically significant increase in hair thickness compared to placebo. Furthermore, the proliferation rate of human hair follicle cells was distinctly higher after BCP treatment. Since it is known that the hair papillae are embedded in a dense extracellular matrix [7, 8], it could be speculated that the previously demonstrated efficacy of BCP to stimulate the synthesis of matrix molecules may also have a positive impact on hair follicles and promote cell proliferation.

The finding that hair thickness significantly increases after BCP intake could be explained by a direct influence of the supplemented peptides on hair metabolism. This reasoning is supported by a study that investigated the effect of BCP intake on the energy metabolism associated with human hair follicle mitochondria [9].

This showed that the mitochondrial activity of follicle cells was significantly increased after BCP supplementation compared to placebo.

Furthermore, it has been shown that orally administered collagen peptides improve microcirculation and increase blood supply [10]. This could have an effect on the metabolism of the hair cells and subsequently lead to increased hair thickness. It can be assumed that the increased thickness also leads to improved textural and physical properties of hair, making it stronger and more resistant to breakage.

Since it is known that collagen peptides can exhibit different biological activities [11], it must be stated that the effects measured

here apply only to these specific BCP and cannot necessarily be applied to other collagen products. In summary, this is the first study to clearly demonstrate a positive effect of specific BCP intake on hair metabolism and thickness. Further investigation would be desirable to better understand the metabolic effects and the underlying mechanism of action.

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