

Nutritional factors and resistance of the hair shaft: a pilot clinic study

Fatores nutricionais e resistência da haste capilar: estudo clínico piloto

ABSTRACT

Introduction: The hair shaft's integrity can be compromised by the presence of some genodermatoses, with the use of cytostatic agents, and in physical-chemical traumas, such as straightening, dyeing, drying, etc.

Objective: To evaluate improvements in hair resistance after the ingestion of a dietary supplement. **Methods:** Patients complaining of hair loss due to breakage, with virgin or processed hair (dyed, straightened, or dyed and straightened) ingested a vitamin supplement for 90 days.

Results: There was clinical improvement in damaged strands that were removed in the pull test, in addition to statistically significant increases in the strength and shine of the hair, as perceived by patients ($p < 0.05$).

Conclusions: Nutrition affects the maintenance of hair's resistance, and supplementation can improve the synthesis of the structures of the hair.

Keywords: supplementary feeding; hair; hair dyes.

RESUMO

Introdução: A integridade da haste capilar está comprometida em algumas genodermatoses, uso de citostáticos, além de traumas físico químicos, como processamentos (alisamentos, tinturas, uso de secadores, etc.).

Objetivo: avaliar a possível melhora na resistência capilar após a ingestão de um suplemento alimentar

Métodos: pacientes com queixa de queda de cabelo por fratura, com cabelos virgens ou processados por tintura, tintura e alisamento ingeriram um suplemento vitamínico por 90 dias.

Resultados: Houve melhora clínica dos fios fraturados removidos pelo pull test e melhora da resistência e brilho do cabelo percebida pelas pacientes, estatisticamente significativas ($p < 0,05$).

Conclusões: há um impacto nutricional na manutenção da resistência do fio de cabelo e a suplementação nutricional pode melhorar a síntese das estruturas do fio.

Palavras-chave: suplementação alimentar; cabelo; tinturas para cabelo.

INTRODUCTION

Hair shafts result from the keratinization of hair follicles, therefore their integrity not only depends on the quality of the keratin that is synthesized in the hair follicle, but also on external factors.¹ The hair shaft's integrity is affected by certain genodermatoses, trichotillomania, and cytostatic drug use, in addition to physical and chemical traumas. Processing (straightening, permanent dye, use of dryers, etc.) are the most common physical and chemical traumas.²

The hair of patients with alterations in the shaft is dry and dull, and the structural changes may or may not produce increased fragility. Hair shaft abnormalities that involve increased fra-

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gility include monilethrix, *pili torti*, and trichorrhexis nodosa. Abnormalities in the hair shaft are also characteristic of many syndromes, including Menkes and Bjornstad syndromes. Nutritional conditions may also affect the resistance of hair.³

However, complaints linked to hair fragility (brittle and dull hair, with a scalp examination not showing evident alterations and normal trichogram), are relatively common in the dermatological practice. Fragility is assessed by using the pull test to measure the number of broken hairs.

The hair shaft's keratin integrity is closely related to the individual's nutritional levels; deficiencies can lead to alterations in the growth rate and color, and in mechanical properties, such as resistance to trauma.⁴

Nutritional supplementation is frequently recommended to treat alopecia are commonly used in telogen effluvium caused by anemia, or other nutritional disorders (malabsorption, weight control diets, etc.)⁵ However, no studies evaluate the effect of nutritional supplementation on reducing hair loss from the fracture of strands by increasing in hair strength.

This study evaluates whether the strength of the hair shaft can significantly benefit from nutritional supplementation.

OBJECTIVE

To verify the possible effects of a nutritional supplement known commercially as Eximia Fortalize® (Farmoquímica S/A – São Paulo, Brazil) to improve the resistance of hair fibers, through the clinical evaluation of patients over time.

Ethical aspects

The study's protocol was submitted to and approved by the Research Ethics Committee. All volunteers signed a term of free and informed consent. The study was conducted and documented in accordance with the international standards for human research (Declaration of Helsinki), the Resolution 196/96 of 10th October 1996 of the Brazilian National Health Council and additions, and Normative Instruction n. 4, which sets out guidelines for good clinical practice.

METHODS

This prospective, randomized, and single-blinded study involved 62 female volunteers (aged 35–65) who had complaints of hair fragility (defined as the breaking of hairs during brushing or any type of handling, such as washing or styling) for more than 3 months. The study took place between March and May 2011 at the Clinical Research Laboratory of the Dermatology Department of Medcin Instituto da Pele (Osasco, São Paulo, Brazil).

The volunteers were divided into three groups according to their description of the condition of their hair: hair without processing, hair processed with dye, and hair processed with dye and straightened.

All volunteers underwent dermatologic evaluation in order to rule out any cutaneous or systemic diseases that could lead to hair fragility or even alopecia due to scalp dermatoses,

endocrinopathies, pregnancy, and breastfeeding. The use of medications that could interfere with the integrity of the hair (antineoplastics and corticosteroids) was an exclusion criteria.

Patients completed a subjective questionnaire that analyzed the following characteristics: hair's resistance, hair loss due to breakage, hair shine, and total volume of hair. The pull test (traction test by standardized brushing), was also performed to count broken strands.

The pull test consisted of three passes with a standard plastic comb (3 mm teeth and 2 mm of space between the teeth, cleansed with 70% alcohol between the collection of hairs), in 3 different areas: one pass from the right parietal area to the right occipital area, one pass from the parietal-frontal area to the middle occipital area, and one pass from the left parietal area to the left occipital area. The comb was always passed in the same direction, totalling 9 passes per volunteer. The broken hairs were subsequently collected and counted.

The volunteers were instructed to take one tablet of the Eximia Fortalize® supplement per day, for 90 days. The tablets contained a combination of nutrients, as shown in Table 1:

Statistical analysis

The treatments were compared at each of the study's experimental time points using the Student's t test.

RESULTS

Sixty patients completed the study. Of those, 31% had unprocessed hair, 36% had dyed hair, and 33% had straightened hair. Two patients did not return for evaluation for reasons unrelated to the study. All patients who completed the study returned for both evaluation visits (60 days after the beginning of the study (T60) and 90 days after the beginning of the study (T90). No adverse reactions were observed or reported in the clinical evaluation.

Clinical Evaluation

The tablets were well tolerated by all participants and none presented or reported adverse reactions.

Pull test evaluation

The pull test was used to clinically evaluate study participants' hair strength by measuring the number of broken strands at T0, T60, and T90.

Group 1 (unprocessed hair): Graph 1 shows the average number of broken hairs after the combing process at baseline (T0), 60 days after (T60) and at the end of the study (T90). The decrease in the mean values represents a statistically significant reduction in the number of broken hairs at the evaluation time points.

Group 2 (dyed hair): Graph 2 shows the average number of broken hairs after the combing process at baseline (T0), 60 days after (T60) and at the end of the study (T90). There was a statistically significant progressive reduction in the average number of broken hairs between the T0 and T60.

Chart 1: Composition of the Eximia Fortalize® nutritional supplement

Component		Dose
Calcium pantothenate	(Vitamin B5)	5mg
Magnesium		130mcg
Ascorbic acid	(Vitamin C)	45mg
Ferrous fumarate	(iron)	7mg
Tocopherols	(Vitamin E)	10mg
Nicotinamide	(Vitamin B3)	16mg
Zinc oxide		3,5mg
Beta-carotene	(Vitamin A)	600mcg
Cyanocobalamin	(Vitamin B12)	24mcg
Thiamin	(Vitamin B1)	1,2mcg
Pyridoxine chlorhydrate	(Vitamin B6)	1.3mcg
Riboflavin	(Vitamin B2)	1,3mcg
Folic acid		240mcg
Biotin		30mcg

Group 3 (dyed and straightened hair): Graph 3 the mean number of broken hairs after the combing process at baseline (T0), 60 days after (T60) and at the end of the study (T90). There was a statistically significant progressive reduction in the average number of broken hairs between T0 and T60.

Although Group 1 (unprocessed hair) demonstrated a higher level of improvement in hair strength based on the pull test, there were no significant between-group differences in results.

Subjective Evaluation

Given that there was no difference between the results obtained in each group, and all volunteers showed an improvement in pull test after 60 days, the subjective evaluation was performed on the entire pool of volunteers, regardless of their group.

Graphs 4, 5 and 7 below depict the results of the improvement perceived by the study volunteers regarding the strength and shininess of the hair, and loss by breakage. Graph 7 shows the perceived improvement in total hair volume.

At the end of the study, volunteers were also asked about the characteristics of the capsules regarding their ingestion.

Smell: the smell was considered adequate by 98% of volunteers (80% classified the capsules as odorless and 18% were indifferent).

Taste: All of the volunteers considered the capsule's taste adequate (77% classified the capsules as tasteless and 23% were indifferent).

Size and easiness of ingestion: Fifty-nine percent of the volunteers considered the capsule easy to swallow, 8% were indifferent, and 33% considered the product difficult to swallow.

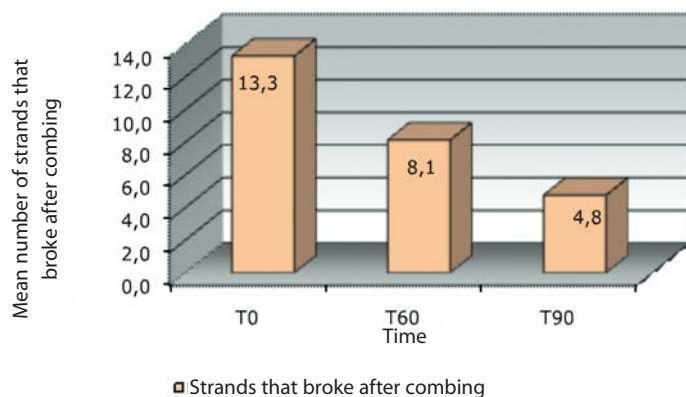
DISCUSSION

Hair fiber synthesis is a dynamic proliferative process, over which the individual's nutritional protein and caloric state has great influence. For example, children with Kwashiorkor disease have thin and sparse hair, with color alterations.^{6,7}

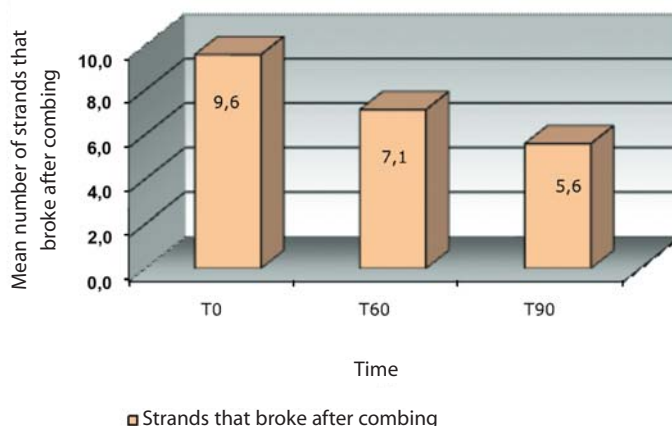
A deficiency of oligoelements and proteins can also lead to alterations in the hair's synthesis. Complex B vitamins act as enzymatic cofactors in the synthesis of keratin, and their deficiency can trigger or worsen seborrhea with inflammation in the scalp.

Though subclinical, deficiencies of iron and zinc may lead to changes in the utilization of essential amino acids in the synthesis of hair. Vitamin C deficiency also causes alterations in hair structure.⁸

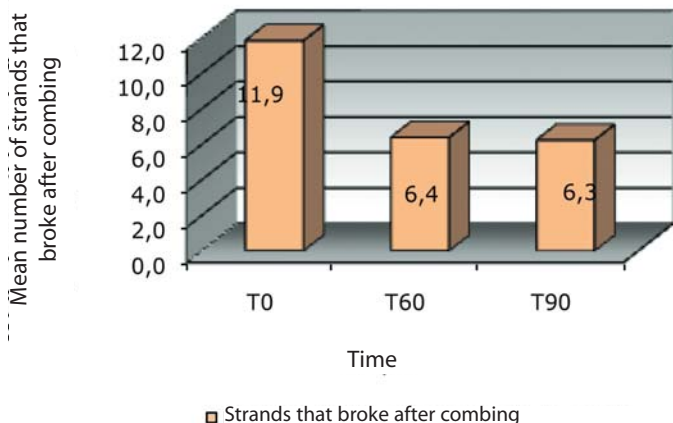
However, there is little evidence in the literature about the impact of nutrition on hair strength. A recent article by Hawryluk and English highlights the impact of nutritional abnormalities on the hair of adolescents.⁹



Graph 1: Mean number of strands that broke after combing – Group 1
(*significant reduction $p < 0.05$)



Graph 2: Mean number of strands that broke after combing – Group 2
(*significant reduction $p < 0.05$, ** non-significant reduction $p = 0.22$)



Graph 3: Mean number of strands that broke after combing – Group 3 (*significant reduction $p < 0.005$, ** non-significant reduction $p = 0.22$)

Despite the difficulty of evaluating the role of each nutrient and diet type on the integrity of hair, these effects are all probably due to the fact that the vast majority of hair dystrophies is related to congenital diseases or physico-chemical trauma. Nevertheless, an analogy with the nails – where states of deficiency, even when subclinical, such as in brittle nails syndrome, may have an important role in the mechanical properties – seems appropriate.

The significant reduction in the mean numbers of strands lost in the pull test (verified in 100% of volunteers) confirms this hypothesis. Processing can damage the hairs' structure, which evidently cannot be repaired. Nonetheless, improving the nutritional conditions of newly synthesized hairs has been demonstrated to increase hair strength.

The use of vitamin supplements in the present study for 3 consecutive months clearly confirmed the literature's findings: there was a significant improvement in the strength of the hairs ($p < 0.05$): 98% of volunteers reported a loss of hair due to fracture at baseline, and after 3 months of using the supplement only 8% had complaints. The hair's shine and volume also presented a significant clinical improvement ($p < 0.05$).

The improvement in hair strength was also evident from subjective assessments: 80% of volunteers reported improvement after two months of use, which rose to 85% improvement after three months.

Adherence to treatment was facilitated by the straightforward dosage: the use of a single daily capsule was well tolerated by volunteers, and no adverse reactions were observed or reported. The capsule's characteristics favored tolerability and adhesion, since most volunteers considered its size, smell and taste unobjectionable.

The condition of the hair prior to the study was not an impediment to significant improvement: there were no statistically significant between-group differences in improvement. Therefore, the use of vitamin supplements may be beneficial for any patient – even those who present major damage to the hair.

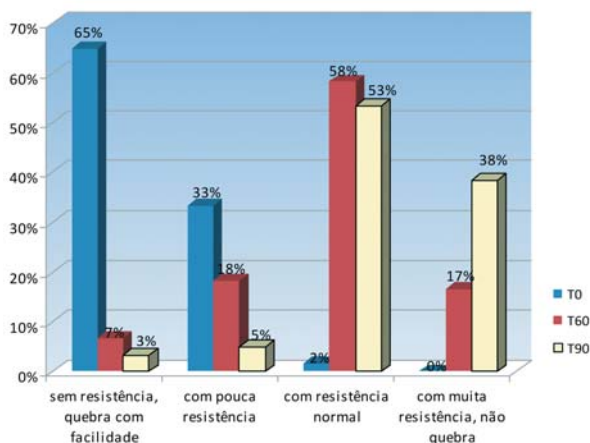


Gráfico 4: Percentual de pacientes com melhora na resistência nos tempos experimentais avaliados; quando comparado ao tempo inicial (T0).

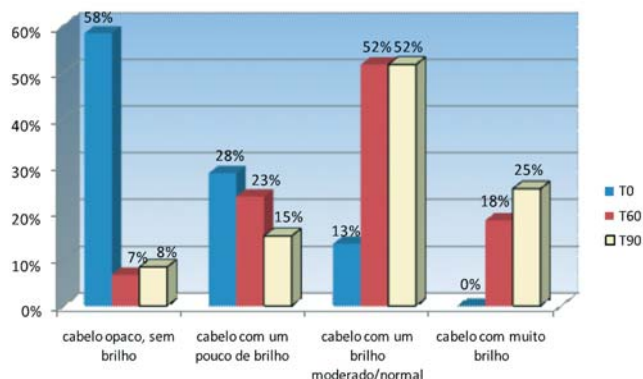


Gráfico 5: Percentual de pacientes com melhora do brilho dos cabelos nos tempos experimentais avaliados; quando comparado ao tempo inicial (T0).

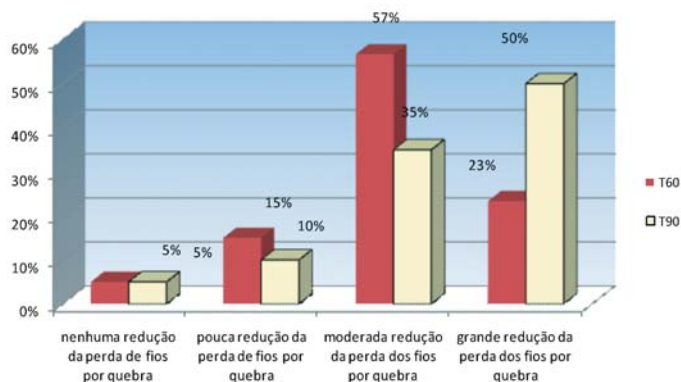


Gráfico 6: Percentual de pacientes com melhora na perda de fios por quebra nos tempos experimentais avaliados (T60 e T90).

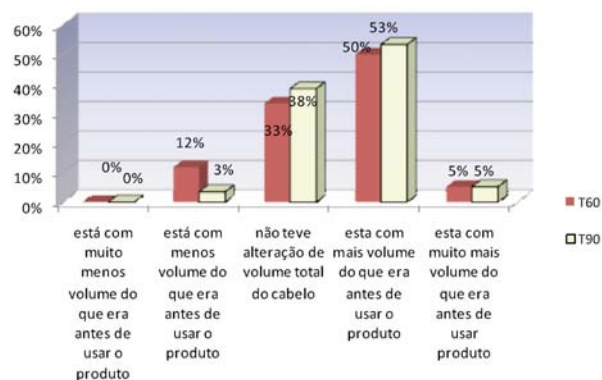


Gráfico 7: Avaliação das pacientes quanto a melhora do volume capilar nos tempos experimentais.

CONCLUSION

There is evidence that combined vitamin supplements and oligoelements (folic acid, biotin, vitamins B1, B2, B3, B5, B6, B12, A, E, and C in addition to the minerals iron, magnesium and zinc) can improve hair strength. This improvement might be explained by the repair of the synthesis of the hair's structures, which reduces the loss due to breakage in the types of hair studied. ●

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