IMPORTANCE OF L-ARGININE FOR HUMAN HAIR ELONGATION

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ABSTRACT

Excessive hair loss may affect up to 60% of men and 40% of women at some point in their life. Topical treatment applied on scalp to fight hair loss and/or to increase hair growth in dermatology clinics remains mainly modeled. Alternatively, hair transplantation is proposed as surgical option. One of the cosmetic approaches to reduce hair loss is to take into account some aspects of the hair follicle environment, in the goal to improve it and to favor hair growth. In view of this, data from the literature (1) have established that the concentration of the semi-essential amino acid L-Arginine varied in the human plasma during a 24h period. L-Arginine is well known to be involved in the control of cell proliferation (polyamines pathway) as well as a precursor of the nitric oxide vascular mediator. For these reasons, we decided to study the impact of various L-Arginine concentrations on in vitro human hair elongation studies and on the modulation of keys genes in the polyamines pathway. The results demonstrated a clear L-Arginine dose-effect on in vitro hair elongation. A clinical study showed an anti-hair loss effect of L-Arginine characterized by an increase of anagen (growing) and a decrease of telogen (resting) hair densities. These results confirmed the interest of an exogenous supplementation of L-Arginine in hair care.

INTRODUCTION

L-Arginine plasma concentration varies during the day and hair shaft contains 8.8 to 9.6% of L-Arginine. Moreover L-Arginine is a precursor of both polyamine and Nitric oxide pathways. Considering the high cell proliferative activity of hair follicle matrix cells on the one hand, and the hair growth dependence upon vasculature on the other hand, it appeared important to study the role of L-Arginine in hair follicle physiology and to study how changes in L-Arginine plasma level could impact human hair elongation.

MATERIALS AND METHODS

For the in vitro study, microdissected hair follicles (volunteer donors with informed consent) were cultured for 24 hours in Williams’ E medium with L-Arginine supplemented with 2 mM L-glutamine, 10 µg/ml insulin, 0.004 µg/ml hydrocortisone and antibiotics. Hair follicles were then treated with L-Arginine (tested from 30 µM to 300 µM) for 24 hours (gene expression analysis), for 3 days (Ki67 expression) or for 12 days (elongation analysis) with renewal of culture medium and treatment every 48 hours. All the experimental conditions were performed with 12 follicles each. Effects on hair elongation were evaluated by measuring the length of each follicle at the beginning of the assay and every two days. Gene expression analysis was performed by RT-qPCR after extraction of RNA. Ki67 antigen expression was evaluated by immunofluorescence on cryosections.

RESULTS

For the in vivo evaluation, one double-blind and randomized clinical study was conducted on healthy male subjects aged 18-55 with AGA grade III to V according to Hamilton’s classification. 1.5% L-arginine in hydro-alcoholic lotion was assessed versus vehicle using the phototrichogram technique (PTG). 33 subjects received the L-arginine lotion (6 ml/day for 1.5 months) and 30 subjects received the placebo (6 ml/day for 1.5 months).

CONCLUSION

This study highlighted the importance of L-Arginine and polyamines pathway for human hair physiology. In the absence of L-arginine, in vitro hair elongation ceased and the expression of polyamine pathway implicated genes clearly increased. It is well known that, under normal arginine supply, the polyamine pathway is activated at a basal level. In view of these results, one can hypothesize on the existence of a biological trigger activating the polyamine pathway once hair follicles enter conditions that deprive growth. In addition, the clinical study showed an anti-hair loss effect of L-Arginine characterized by an increase of anagen hair density (hair in a growth status) and a decrease of the telogen hair rate (resting status). These results confirmed the interest of an exogenous supplement of arginine in hair care.

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