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ERRATUM

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Effect of Dietary Supplementation With INVERSION® Femme on Slimming, Hair Loss, and Skin and Nail Parameters in Women

Alain Jacquet, MD

Département de Pharmacologie Clinique
Université Victor Segalen
Bordeaux, France

Véronique Coolen

Inversion Laboratoires
Hasselt, Belgium

Jacques Vandermander, PhD

VDMJ Conseil
Cagnes sur Mer, France

ABSTRACT

In modern society, the ideal of slim women with beautiful hair, skin, and nails is well established. The process of aging, together with an unhealthy diet and little physical exercise, often leads to deterioration of this ideal. Two open clinical trials were conducted to investigate the effect of the proprietary oral supplement INVERSION® Femme (Inversion Laboratoires, Hasselt, Belgium) on slimming in overweight women and on hair loss, as well as on skin and nail parameters. A total of 22 overweight women aged 38 to 63 y participated in the study that explored slimming activity. In the hair loss study, 30 women aged 38 to 67 y who had experienced hair loss were examined. All 52 women in both groups were further evaluated for skin (ie, wrinkles and hydration) and nail improvement. The active ingredients in INVERSION Femme, subdivided into 2 different capsules, exhibit antioxidative activity and nutritional function; in addition, they contribute to enhanced microcirculation, tonus, and thermogenesis. Weight reduction and slimming were measured after INVERSION Femme was taken for 28 and 58 d. All women showed significant reductions in weight, body fat, and thigh circumference. During the second month of treatment, subjects showed an average 50% reduction in hair loss. INVERSION Femme is a potent “all-in-one” antiaging dietary supplement that causes significant slimming and reduction in hair loss, as well as visible improvement in skin and nail structure.

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Address reprint requests to
Véronique Coolen
Inversion Laboratoires
Kategastraat 8
3500 Hasselt, Belgium
Email: sales@inversionworld.com

Keywords: | dietary supplement; weight reduction; slimming; hair loss; aging; nails; wrinkles; skin hydration

INTRODUCTION

The various effects of aging on the human body diminish youthful appearance and feeling. Overweight, aging skin, and thinning hair are major beauty concerns, especially for older women. In addition, excess weight is often accompanied by cellulite formation, causing even greater dissatisfaction with skin appearance in several body areas.

Women who are middle-aged and those who are older often do not engage in regular physical activity and have an unbalanced diet, along with reduced hormone activity. Adverse changes in microcirculation and reduction in the natural defense mechanism against free radicals cause an increase in the visible signs of aging.

In regard to the skin, hair, and nails, aging contributes to reduced cell development and the slowing of collagen and keratin synthesis, resulting in skin dryness and wrinkles, alopecia, brittle nails, and generally slower growth of hair and nails and slower skin regeneration. At the same time, body weight and shape change. Disturbed carbohydrate and lipid metabolism and age-related reduction in thermogenesis lead to increased body weight and to local water and fat storage.

Although aging cannot be prevented, the effects of aging can be slowed through various methods. These include regular physical exercise and a healthy diet with high-quality food, including plenty of fruits, vegetables, and seafood. Other methods include cessation of smoking and excessive alcohol consumption and the elimination of certain fats, sugars, and caffeine from the diet.

In addition to numerous cosmetics, several dietary supplements have been developed to improve skin, hair, and nails, and overall body weight.¹ Older people, who may not have an extremely healthy lifestyle, often profit from dietary supplementation of vitamins, minerals, and other health-supporting ingredients; however, few products have an acceptable overall product composition and display clinically proven efficacy.

INVERSION[®] Femme (Inversion Laboratoires, Hasselt, Belgium) is a dietary supplement that is composed of several synergistically functioning components, including minerals, vitamins, essential fatty acids that contain oils, green tea, and grape extract, and shark cartilage (Table). The formulation is patent pending in Europe and the United States. The ingredients of INVERSION Femme are known to contain antioxidants and other ingredients that support microcirculation and nutritional function. Several of these ingredients enhance slimming and thermogenesis.

The investigators explored the effects of INVERSION Femme on slimming and hair loss in overweight women, as well as on skin and nail parameters, in 2 open clinical trials with a total of 52 subjects.

Natural Active Ingredients of INVERSION Femme

Active Ingredients	Anti-oxidant	Micro-circulation	Nutritional Function	Thermogenesis/ Slimming Activity	Daily Dose, mg
2 red morning capsules (daily dose)					
Green tea extract	✓			✓	400
Vitamin C	✓	✓		✓	120
Natural beta carotene	✓				4.8
Zinc	✓		✓		10
Selenium	✓	✓	✓		0.040
Chromium	✓			✓	0.025
Borage seed oil (omega 6 PUFA)		✓	✓		700
1 silver evening capsule (daily dose)					
Grape extract	✓	✓		✓	150
Shark cartilage	✓		✓		100
Vitamin B ₂ (riboflavin)	✓		✓		1.6
Vitamin B ₅ (pantothenic acid)	✓		✓	✓	6
Vitamin B ₆ (pyridoxine)	✓		✓		2
Vitamin B ₈ (biotin)			✓	✓	0.150
Copper	✓		✓	✓	1
Iron	✓		✓	✓	10
Fish oil (omega 3 PUFA)	✓	✓	✓	✓	350

PUFA=polyunsaturated fatty acid.

SUBJECTS AND METHODS

Trial Setup

This article evaluates the results of 2 clinical trials. Both trials were conducted on an "open" basis, without a reference product, at the Department of Clinical Pharmacology, at Victor Ségalen University of Medicine, in Bordeaux, France, between November 2003 and February 2004.

The primary objective of the weight loss trial was to assess efficacy and tolerability of INVERSION Femme in overweight women. The primary objective of the hair loss trial was to assess the product's efficacy and tolerability in women who experienced hair loss. Secondary objectives of both trials were the assessment of efficacy of the test product on skin, hair, and nails, as well as the tolerability of the product.

Study Population

The weight loss trial comprised 22 female volunteers whose age distributions were as follows: 35 to 40 y (n=2), 41 to 45 y (n=7), 46 to 50 y (n=4), 51 to 55 y (n=6), 56 to 60 y (n=2), and 61 to 65 y (n=1). Except for 1 patient who missed the day 28 checkup because of the flu, the remainder of the patients (n=21) completed the study per protocol.

The hair loss trial comprised 30 female volunteers whose age distribution was as follows: 35 to 40 y (n=4), 41 to 45 y (n=7), 46 to 50 y (n=8), 51 to 55 y (n=6), 56 to 60 y (n=2), and 61 to 65 y (n=3). Except for 1 patient who did not attend the final checkup for personal reasons, the remainder of the patients (n=29) completed the study per protocol. The population of both trials was used for assessment of secondary parameters.

All 52 volunteers (mean age, 48.5 y) were assessed for their skin hydration state and the condition of their nails. Sixteen volunteers were evaluated for wrinkles (mean age, 50.2 y).

Study Medication

Each subject took 2 soft red capsules in the morning and 1 soft silver capsule in the evening on a daily basis. The concentration of the individual ingredients taken per day is shown in the Table.

Three consultations were held during the weight loss trial on days 0, 28, and 56; 4 consultations were held during the hair loss trial on day -28 (before intake) and on days 0, 28, and 56. An assessment questionnaire was completed at the consultation sessions held on days 28 and 56, to document the efficacy and acceptability of the product. After this satisfaction evaluation was completed by study subjects, assessment criteria as defined below were measured.

Inclusion Criteria

Subjects in both trials were required to be female and aged 35 y or older; in addition, characteristics by which secondary trial objectives could be assessed (eg, hair loss, nail abnormalities, dry skin, wrinkles, or surface creasing around the eyes [crow's feet]) were favorable for inclusion.

For the weight loss trial, subjects were required to be overweight (weight/height² ratio or body mass index of between 25 and 30). Actual mean body weight was 72.90 kg and mean height was 1.62 m, resulting in a mean body mass index of 27.84.

For the hair loss trial, subjects were required to present with abnormal hair loss. They were required to attend 2 precisely scheduled visits at the hairdresser (day -28 and day 28) for the same haircut.

All subjects signed the declaration of informed consent form required for participation in the study and were willing to attend required examinations.

Exclusion Criteria

Subjects excluded from these trials were those who were following a course of medical treatment that affected their skin or weight (eg, isotretinoin, corticoids, appetite suppressors), pregnant and breastfeeding women, and women who had given birth less than 3 mo previously.

For the weight loss trial, subjects who planned to make significant changes to their dietary habits during the study (in particular, a weight loss diet) were excluded.

For the hair loss trial, subjects who planned to make significant changes to their hair during the study were excluded.

Subjects were discontinued from study participation due to pregnancy, withdrawal decision (no justification required), illness or initiation of medical treatment that might interfere with results of the trial, or development of an adverse effect deemed by the researcher to justify exclusion from further participation.

Assessment Criteria

Tolerance

Tolerance was assessed by both researchers and subjects, it was graded between 1 (excellent) and 4 (poor).

Hair Loss Quantity

Subjects' hair was brushed normally (with at least 15 back-forward and 15 forward-back strokes). Each brushing session was recorded on a timetable. Brushing was done only on dry hair before a shower or bath. From day -28 to day 0, subjects did not take the nutritional supplement to allow baseline assessment of hair loss.

After days 0 to 28, when the subjects had been taking the nutritional supplement for 4 weeks, they were assessed. Then, from day 28 until day 56, they continued to take it until the end of the trial, so its effect on hair loss could be assessed.

During both of these phases, hairs that fell out during brushing were gathered in plastic bottles that had been weighed before the time of filling. Each bottle was then weighed after filling for determination of the weight of hair that had fallen out during 4 wk without treatment, followed by 4 wk during which the nutritional supplement was taken. Weights recorded were divided by the actual number of days of brushing to ensure accuracy even when the subject had been unable to brush her hair for 1 or 2 days (such as over the weekend).

Body Circumferences

Thigh circumference was measured with a tape measure according to the technique demonstrated by A. Jacquet at the French Cosmetology Conference of November 1992.² This technique allows accurate and reproducible measurement, performed at precisely the same height at each consultation and was used to measure the circumference of the abdomen around the navel.

Thigh Volume

The volume of a single section of thigh was calculated as follows: part of the thigh marked off by 2 parallel lines was compared with the body of a cone with known circumferences of the larger and smaller extremities and a known height of 30 mm.

The volume of the body of cone V was calculated as follows:

$$V_g = (Y_g^2 + y_g^2 + Y_g y_g) * H / 12 \pi$$

$$V_d = (Y_d^2 + y_d^2 + Y_d y_d) * H / 12 \pi$$

$$V_{\text{average}} = (V_g + V_d) / 2$$

where Y_g is the uppermost point on the left-hand side, y_g is the lowermost point on the left-hand side, Y_d is the uppermost point on the right-hand side, and y_d is the lowermost point on the right-hand side.

Weight

Weight, body fat, and lean body mass of subjects were recorded at each checkup with the use of CALOR brand impedance scales.

Skin Hydration

Skin hydration was measured at each checkup on the outer side of the leg. Subjects were instructed not to apply any moisturizing product to that area for at least 4 days prior to the checkup (Corneometer[®] CM 820, Courage & Khazaka, Koln, Germany).

Wrinkles and Surface Creasing

A silicon print was taken of the crow's feet of those subjects who had such wrinkles. These prints were then analyzed with a laser profilometer with the aim of determining selected wrinkle variables. The level of accuracy of this analysis was equivalent to that of a micrometer.

All assessment criteria, except for nail parameters, are objective criteria that are based on measurements, such as profilometry of the silicon imprint of wrinkles by laser beam, skin hydration measurement by corneometer, weight and body fat by impedance balance, and waist and thigh measurement according to the published specific protocol; hair loss was assessed by weighing the quantity of hair lost each month.

Statistical Analysis

Average measurements taken for each subject were compared (paired series). The trial therefore included a bilateral parametric test (Student t test), wherein the distribution of differences followed a standard model (verified with the Shapiro-Wilk W test), and a nonparametric test (Wilcoxon) that was performed with uncertainty as to this condition.

The alpha risk (α) was set at .05. The standard error of the mean (SEM) is indicated on each diagram.

RESULTS

Tolerance

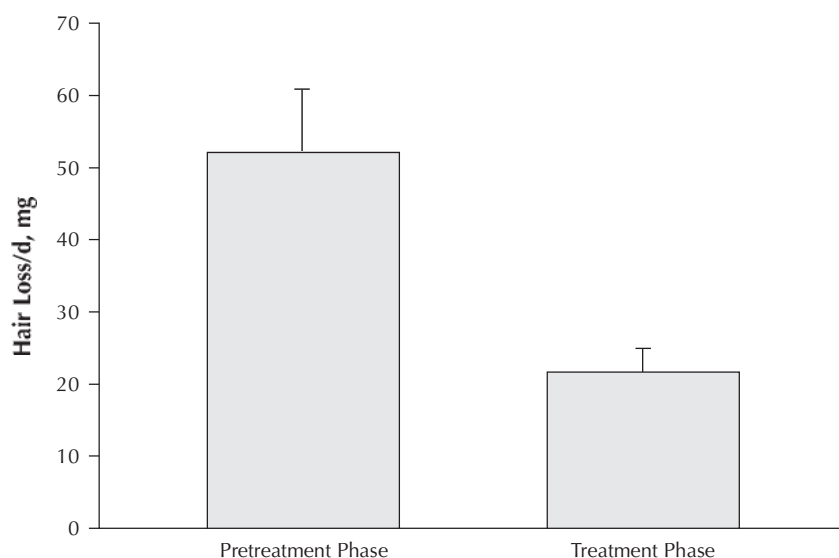
In both trials, most subjects reported excellent tolerability. Only a few subjects described digestive troubles, such as heartburn, nausea, and vomiting, after taking the morning capsules. This discomfort disappeared immediately when subjects began to take the product with a plentiful breakfast or lunch.

Hair Loss

In all, 30 women took the nutritional supplement INVERSION Femme to reduce abnormal hair loss (principal inclusion criterion); excess weight and problem nails and skin (eg, wrinkles, surface creasing) were secondary, noncompulsory inclusion factors.

Hair loss was assessed by measuring the amount of brushed-out and collected hair following identical haircuts at the beginning of each hair collection phase. Hair loss in the 28 d prior to supplementation was compared with hair loss during the supplementation period (days 28 to 56). A highly significant reduction in hair loss was observed during the treatment phase, as compared with the pretreatment phase (Fig 1). In the pretreatment phase, a mean of 52.0 mg/d (± 48.1 mg) was brushed out as compared with 21.6 mg/d (± 17.7 mg) in the treatment phase. This demonstrates a hair loss-reducing effect attributable to INVERSION Femme supplementation.

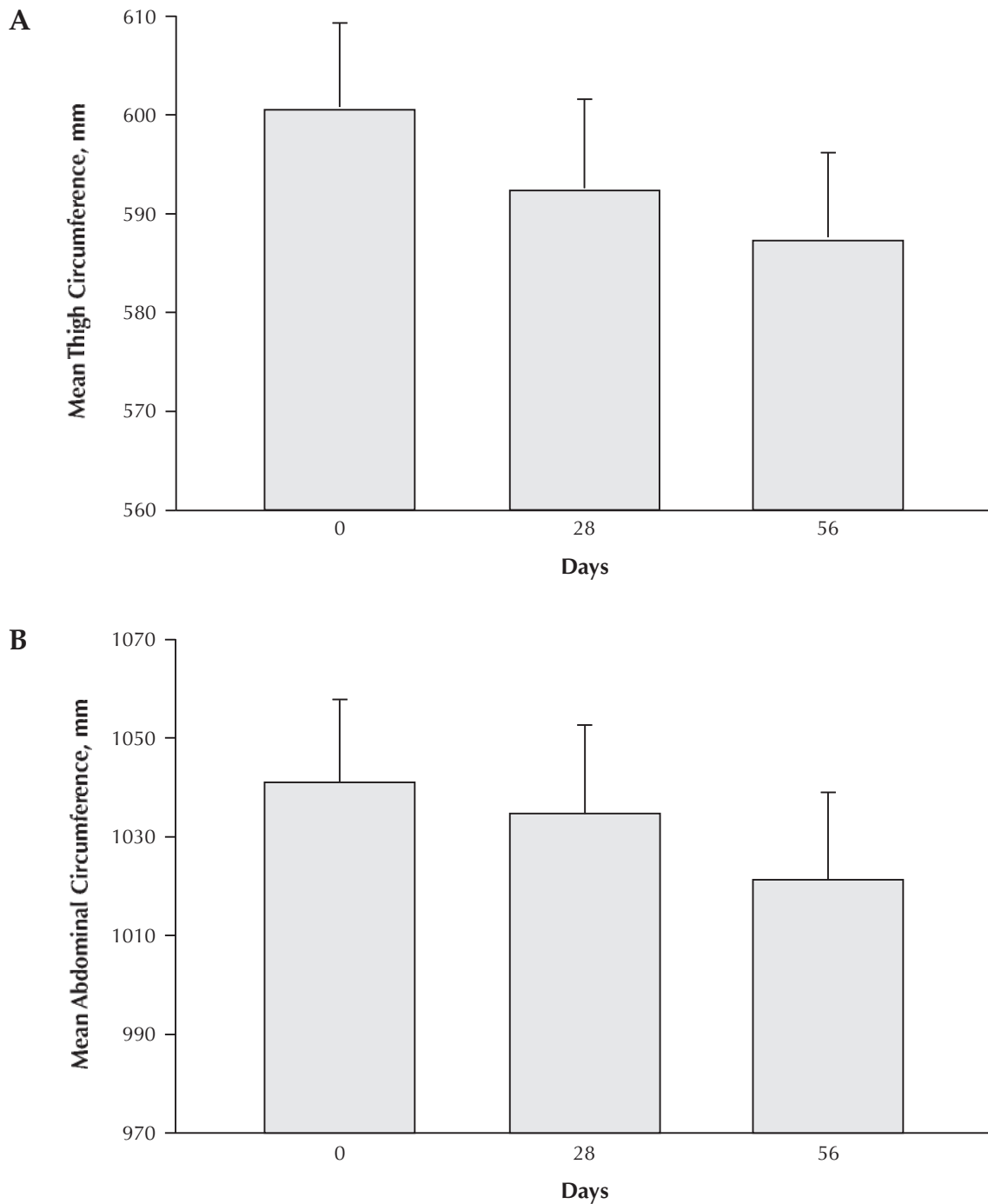
Fig 1. Hair loss without and with INVERSION Femme consumption.



The reduction in hair loss due to INVERSION Femme consumption is highly significant, with a value of $P < .0001$ in group comparisons. Error bars indicate SEM.

This conclusion is supported by reports of almost complete satisfaction regarding hair loss reduction outcomes among volunteers in the overweight group who had reported hair loss problems (approximately 12 subjects) (data not shown).

Fig 2. Body circumferences of overweight women are significantly reduced with INVERSION Femme consumption.



A: Mean thigh circumference before supplementation and after 28 and 56 d of supplementation with INVERSION Femme. Error bars indicate SEM. Significance: after day 28, $P<.0001$; after day 56, $P=.0001$; and between days 28 and 56 of treatment, $P<.0001$.

B: Mean abdominal circumference before supplementation and after 28 and 56 d of supplementation with INVERSION Femme. Error bars indicate SEM. Significance: after day 28, $P<.0003$; after day 56, $P=.0001$; and between days 28 and 56 of treatment, $P<.0001$.

Body Weight Reduction

A total of 22 overweight women who were taking INVERSION Femme supplementation were evaluated for the following weight loss parameters: body circumferences, thigh volume, and total body weight.

Body Circumferences

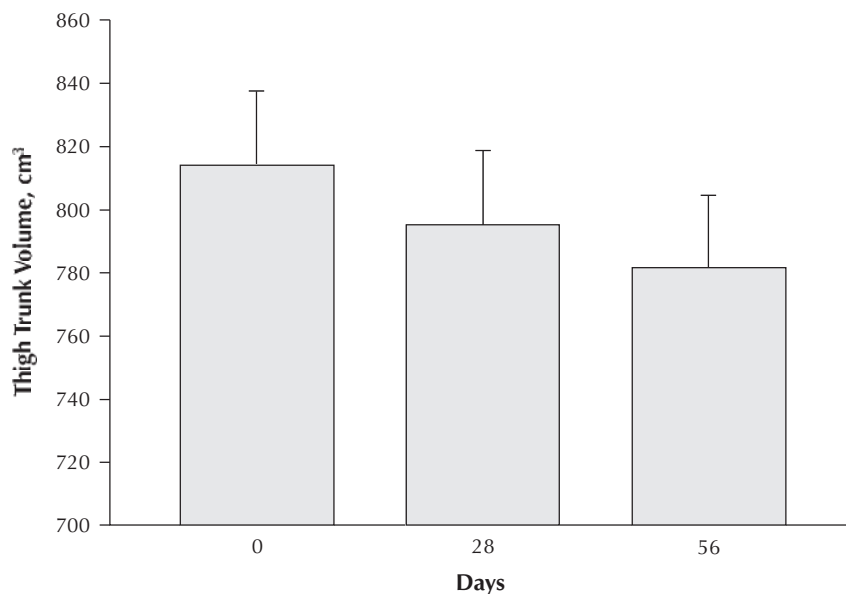
Mean thigh circumference before supplementation was 600.75 mm (± 40.27 mm). By day 28, this circumference had been reduced to 592.60 mm (± 41.78 mm), and by day 56, to 587.41 mm (± 41.56 mm) (Fig 2A). Average thigh circumference had decreased significantly after 28 d ($P < .0001$), after 56 d ($P = .0001$), and between days 28 and 56 of treatment ($P < .0001$).

Mean waist circumference before supplementation was 1040.50 mm (± 78.20 mm). By day 28, this circumference had been reduced to 1034.24 mm (± 81.28 mm), and by day 56, to 1021.05 mm (± 81.47 mm) (Fig 2B). This represents a significant reduction in average abdominal circumference after 28 d ($P < .0003$), after 56 d ($P = .0001$), and between days 28 and 56 of treatment ($P < .0001$).

Thigh Volume

Average thigh trunk volume before supplementation was 814.6 cm³ (± 106.3 cm³). After supplementation, a decrease to 794.8 cm³ (± 108.2 cm³) and 781.4 cm³ (± 107.5 cm³) was observed on days 28 and 56, respectively (Fig 3). Therefore, the average volume of the thigh trunk had decreased significantly after 28 d ($P < .0001$), after 56 d ($P < .0001$), and between days 28 and 56 of treatment ($P = .0001$).

Fig 3. Reduction in average thigh trunk volume due to 28 and 56 d of supplementation with INVERSION Femme.



The observed reduction is statistically significant: after day 28, $P < .0001$; after day 56, $P < .0001$; between days 28 and 56 of treatment, $P = .0001$. Error bars indicate SEM.

Weight

Average body weight before supplementation was 72.90 kg (± 8.53 kg). After supplementation, a decrease to 72.43 kg (± 8.53 kg) and 71.71 kg (± 8.23 kg) was observed on day 28 and 56, respectively (Fig 4A). This decrease was significant after 28 d ($P=.003$), after 56 d ($P<.0001$), and between days 28 and 56 of treatment ($P=.002$).

Most of this body weight decrease was due to a decrease in body fat (Fig 4B), which was also significant after 28 d ($P=.015$) and 56 d ($P<.0001$), as well as between days 28 and 56 of treatment ($P=.002$). In contrast, the reduction in lean body weight was relatively small and was not significant between days 28 and 56 (data not shown).

Skin and Nail Improvement

Skin Hydration

Hydration of the outer side of a single leg was measured with a corneometer on day 0, day 28, and day 56 inside a room where no specific temperature or hygrometric conditions had been imposed. Under these trial conditions, hydration of the cutaneous skin layer (outer side of 1 leg) increased significantly between days 0 (54.47 ± 7.01) and 28 (56.73 ± 7.73), between days 28 (56.73 ± 7.73) and 56 (61.71 ± 7.68), and again between days 0 and 56 ($P=.027$, $<.0001$, and $<.0001$, respectively) (Fig 5A). Average skin hydration increased by 13.3% in 2 mo.

Wrinkles

The crow's feet wrinkles of 16 subjects were analyzed for their complexity, depth, and volume at days 0 and 56 (Fig 5C). All wrinkle parameters significantly improved by the end of the study (Figs 5B, 5D, and 5E). At day 0, the mean wrinkle complexity was 24.5% ($\pm 9.9\%$). Compared with 17.6% ($\pm 7.9\%$) at day 56, wrinkle complexity was dramatically decreased by 25.4% ($P<.001$). Also, average wrinkle depth was significantly decreased by 27.2% ($P<.003$) ($320\ \mu\text{m} \pm 146\ \mu\text{m}$ at day 0 to $213\ \mu\text{m} \pm 83\ \mu\text{m}$ at day 56), and average wrinkle volume was significantly decreased by 22.8% ($P<.003$) (day 0, $0.595\ \text{mm}^3 \pm 0.352$ and day 56, $0.4\ \text{mm}^3 \pm 0.166$).

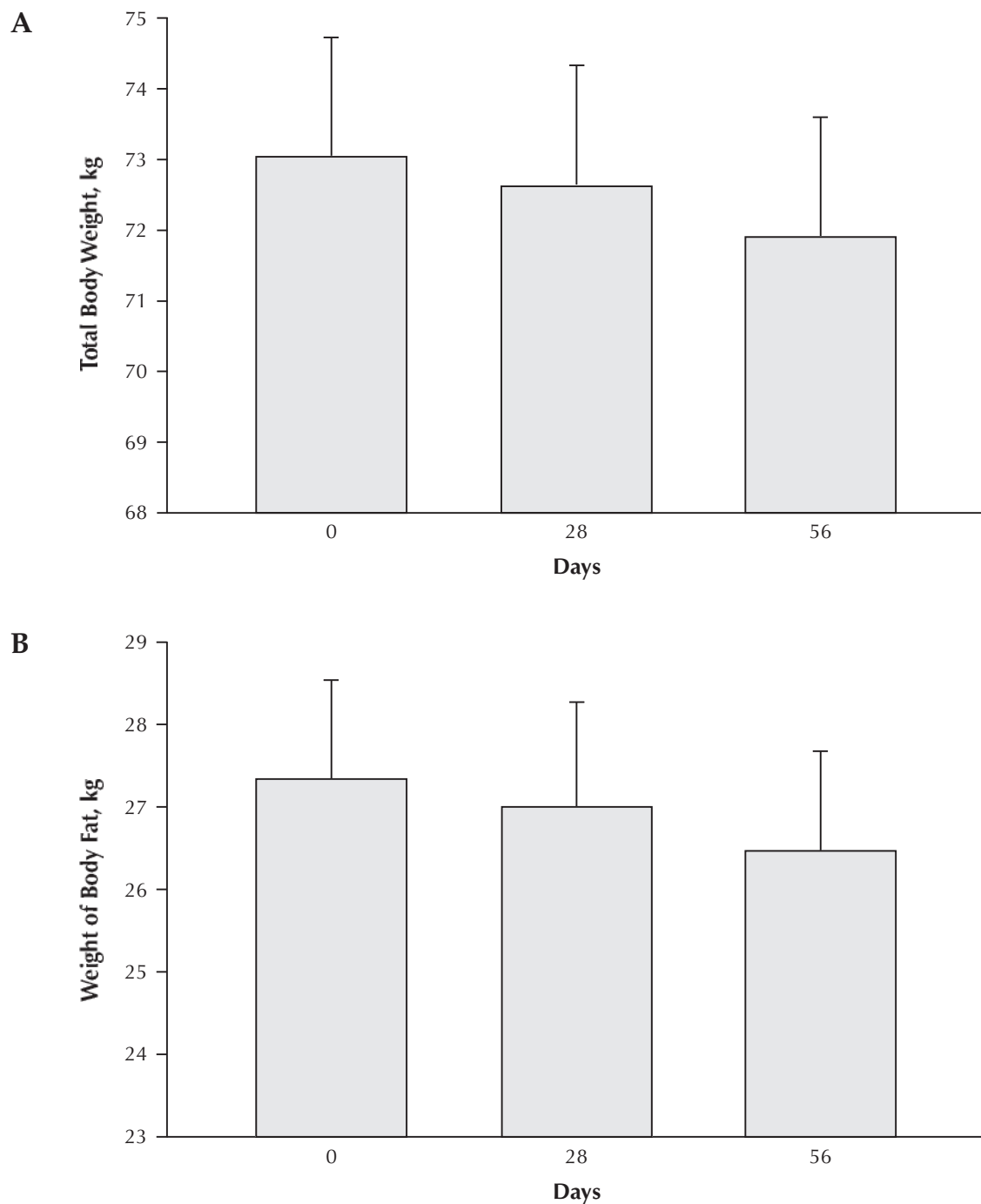
Nails

Among 52 subjects, 30 reported problems with their nails at the beginning of the trials. By the end of the trial, two thirds of these subjects had observed some improvement (eg, harder nails, nails that broke less easily or grew better) (data not shown).

Subject Satisfaction

Eighty-six percent of subjects in the hair loss trial were "highly satisfied" or "satisfied" with the product ($n=10$ and $n=16$, respectively); 11 of these participants even noted improvement in hair loss within the first 2 wk of taking INVERSION Femme; 17 became aware of this effect after 4 to 6 wk of treatment. This also explains why 86% of trial subjects said that their feelings about regular use of this product were "favorable" or "favorable where necessary" ($n=18$ and $n=8$, respectively).

Fig 4. Reduction in average body weight and body fat after 28 and 56 d of supplementation with INVERSION Femme.

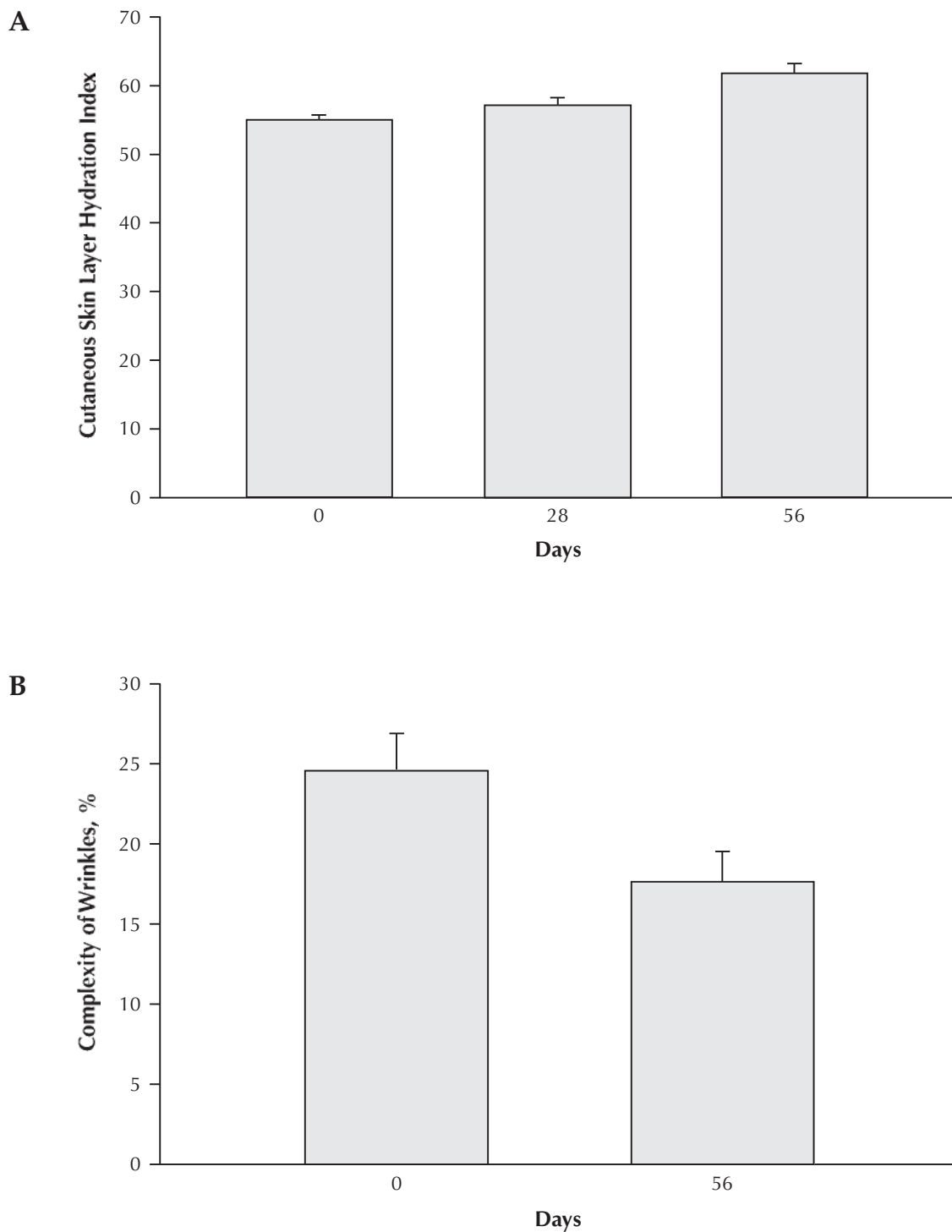


Observed reductions are statistically significant. Error bars indicate SEM.

A: Body weight reduction. Significance: after day 28, $P=.003$; after day 56, $P<.0001$; between days 28 and 56 of treatment, $P=.002$.

B: Body fat reduction. Significance: after day 28, $P=.015$; after day 56, $P<.0001$; between days 28 and 56 of treatment, $P=.002$.

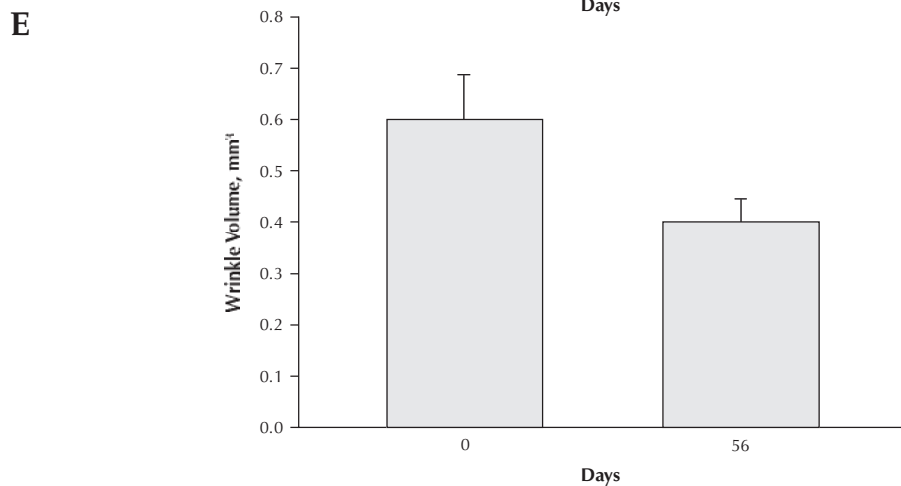
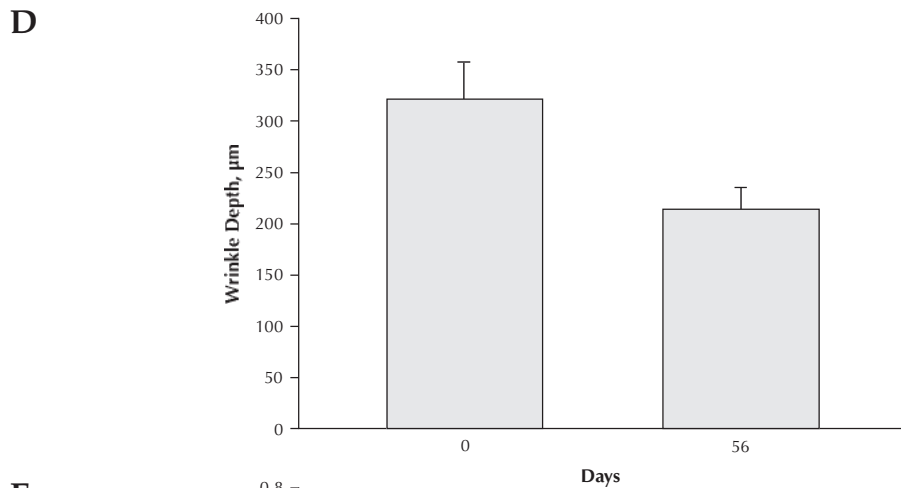
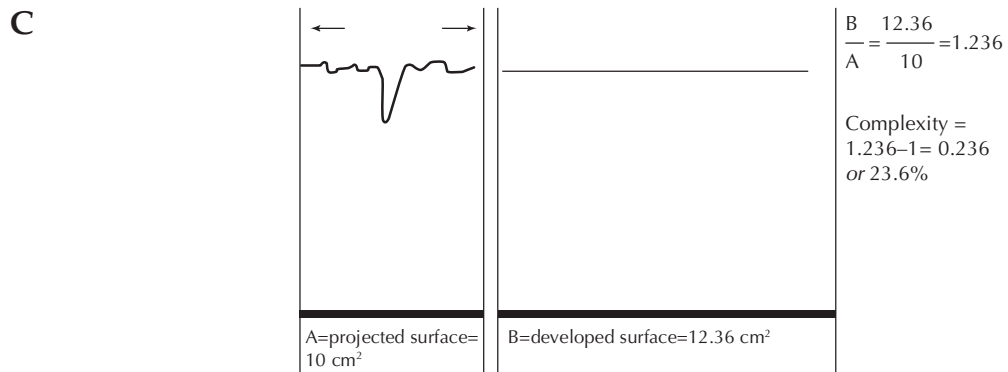
Fig 5. Improvement in skin parameters due to INVERSION Femme supplementation.



A: Skin hydration, measured as cutaneous layer skin hydration index, at day 0, day 28, and day 56. Significance: between day 0 and day 28, $P=.027$; between days 28 and 56, $P<.0001$; and between days 0 and 56, $P<.0001$.

B: Average complexity of wrinkles at days 0 and 56. Significance: between days 0 and 56, $P<.001$.

Fig 5. Improvement in skin parameters due to INVERSION Femme supplementation (cont'd).



C: Explanation of the measurement method of wrinkles by example. Complexity is the ratio of the developed skin surface area to the ground plan projection of this surface. The complexity ratio is a percentage over 100%: if this ratio is 1.236, complexity is 23.6%. Complexity is a measure of the visual impact of the wrinkle: the visibility of the wrinkle is therefore proportional to its distorted surface.

D: Average wrinkle depth at days 0 and 56. Significance: $P < .003$.

E: Average wrinkle volume at days 0 and 56. Significance: $P < .003$.

Error bars in A, B, D, and E indicate SEM.

A total of 50% of subjects were “highly satisfied” or “essentially satisfied” (n=5 and n=6, respectively) with the product in terms of weight loss and rated the product “highly effective” or “quite effective” (n=6 and n=5, respectively) in terms of slimming. A considerable majority of subjects (17 of 22) felt “less bloated” at the end of the trial. Most volunteers (11 of 17) were pleased with their cellulite reduction, and 14 were “highly satisfied” or “quite satisfied” with the effect of the product on their skin. Of 18 subjects, 13 confirmed a “good” or “quite good” improvement in their skin and indicated that their skin hydration was “considerably better” or “better” (n=4 and n=9, respectively). Improvements varied from person to person and included changes in smoothness, firmness, and elasticity of the skin. Most volunteers whose skin had regularly felt taut or uncomfortable in the past indicated that this sensation, at best, had disappeared or, at least, had decreased. Just more than half of trial subjects who had wrinkles or surface creasing at the start of the trial were satisfied by improvements in these parameters. Almost all subjects with nail abnormalities were “highly satisfied” or “quite satisfied” with the effect of the product on their nails.

Overall, subjects reported that treatment was globally satisfactory. A significant majority of trial subjects did not consider the product a burden and indicated that the capsules were easy to take, and that their taste and odor were entirely acceptable. Some subjects nonetheless criticized the size of the capsules.

DISCUSSION AND CONCLUSIONS

Even though aging is a natural process, humans, particularly middle-aged women, wish to slow down this process. Visible signs of aging, such as dry skin, loss of elasticity, wrinkles,³ brittle nails, thinning hair, weight gain, and body shape changes are a major concern. To reduce these effects of aging, a novel dietary supplement, INVERSION Femme, the first all-in-one “antiaging” food supplement for skin, hair, nails, and body shape, was invented. The effectiveness of this product was tested in 2 open clinical trials with a total of 52 subjects. Despite the relatively small number of subjects and the short study time, supplementation with INVERSION Femme resulted in a statistically significant reduction in weight, body circumference, hair loss, and wrinkle complexity. This indicates that the number of subjects and the duration of the study were sufficient. Placebo-controlled clinical studies with a larger number of subjects would be necessary to substantiate these results.

Activity on Weight and Slimming

To avoid the weight gain generally observed during aging, it is important to stimulate metabolism and activate thermogenesis, which is often reduced in women who have experienced weight fluctuations during their young adulthood (“yo-yo dieting”). Because of this, their energy requirements are reduced; this leads to redistribution of glucose from muscle to white adipose tissue.⁴ INVERSION Femme combines several ingredients that enhance thermogenesis (eg, green tea extract,⁵ vitamin C, grape extract) and thereby activate fat burning and slimming. Therefore, it is not surprising that a decrease in all weight loss parameters was observed between consultations. Mean body fat of 27.3 kg was reduced by an average of 886 g during the duration of the trial. Lean body weight also dropped, but not to a significant degree,

between days 28 and 56. It is important to note that the study was conducted at a time of year that is not conducive to weight loss. Participants were selected between November 19, 2003, and December 12, 2003; for most, final trial checkups were carried out during the month of January 2004. Participants were told not to change their usual eating behavior. Even without changing their normal diet, and with eating more during the Christmas and New Year holiday season, a significant reduction in body weight (on average, 1.191 kg/2 mo) occurred, especially a reduction in body fat. It is evident that the festive season during which excessive eating has become commonplace is likely to have offset the results of this study. It could be hypothesized, therefore, that were the same trial to be conducted at another time of year, the results may very well have been even better; however, INVERSION Femme is more than a slimming product. Additional target areas are the skin, hair, and nails; it is also designed to help control the parts of the figure (waist, thighs) that tend to expand with aging.

Activity on Hair

Loss of hair (alopecia) affects both women and men and is often associated with social and physiologic well-being. Twenty-five percent of women between the ages of 35 and 45 y are affected by androgenetic alopecia,⁶ and hair thinning increases with age.

Statistical analysis of the weight of hair presented during the first and third periods was conducted; the amount of hair loss was found to decrease significantly by 50.7% ($P < .0001$). These results were overwhelmingly backed by answers provided by subjects on study questionnaires, broken down as follows: (1) 23 of 30 subjects in the hair loss study initially experienced bad or quite bad hair loss; only 3 reported the same results at the end of the trial; (2) 29 of 30 subjects initially experienced bad or very bad hair loss during washing; only 8 reported this same issue at the end of the trial; and (3) 29 of 30 subjects initially experienced bad or very bad hair loss during brushing; only 7 described this same problem at the end of the trial.

Even though other studies on alopecia have reported success in hair loss reduction, the application of INVERSION Femme is much more comfortable than, for example, electromagnetic pulses.⁶

Most subjects were highly satisfied or satisfied (86%) with the product's ability to reduce hair loss and are favorable regarding regular use of this product. Among these subjects, some had previous experience with other oral hair loss therapies but reported less satisfaction (only 63%) with these other products.

It has been shown that iron, as one of the ingredients in the evening capsule, is known to prevent hair loss in nonanemic women.^{7,8} It is important to note that iron is not given together with vitamin C, an ingredient of the morning capsule (see below).

Activity on Skin and Nails

During aging of the skin, collagen production slows, dead skin cells do not shed as quickly, and skin cell rejuvenation decreases, leading to drier skin, wrinkles, and brittle nails. The efficacy of INVERSION Femme in terms of these parameters was examined.

Under trial conditions, hydration of the cutaneous skin layer (outer side of the leg) increased significantly between days 0 and 28, between days 28 and 56, and again between days 0 and 56. Average skin hydration increased by 13.3% in 2 mo.

Crow's feet wrinkles, a visible sign of skin aging, were examined by silicon prints taken of these wrinkles and through analysis with a laser profilometer. At the end of the trial, the complexity, depth, and volume of these wrinkles had decreased significantly by 25.4%, 27.2%, and 22.8%, respectively.

Of 52 subjects, 30 reported problems with their nails at the beginning of the trials. By the end of the study, two thirds of these subjects had improved in this respect (eg, harder nails, nails that split or broke less easily, nails that grew better).

Biotin (vitamin B₈), an ingredient of INVERSION Femme, is a water-soluble B vitamin that is an essential cofactor for several enzymes. Humans are not able to synthesize biotin. It must be derived by dietary sources or through synthesis by intestinal bacteria. Several clinical studies have demonstrated the positive effect of biotin on brittle nails⁹⁻¹¹ and on hair loss, as well as on dermatitis, although the mechanism is still unknown.

The results reported here are of considerable interest, particularly given that dryness of the skin, wrinkles, and nail problems were not criteria for inclusion in these trials. For several subjects, hydration levels recorded at the measurement point were already normal at the start of the trials. For these subjects, the difference in hydration between the start and the end of the trial was naturally relatively modest, in contrast to those subjects whose initial skin condition was considerably drier. It is likely that this factor offset the good results obtained.

Active Ingredients of INVERSION Femme

INVERSION Femme must be taken twice a day: in the morning, 2 red capsules, and in the evening, 1 silver capsule. The tolerance of the test product was globally satisfactory. Digestive problems experienced by a few subjects after taking the product in the morning on an empty stomach vanished when the capsules were taken after breakfast or with lunch.

Ingredients that neutralize each other are separated into the morning and evening capsules. As an example, it is well known that zinc decreases intestinal absorption of iron and copper.¹² For this reason, zinc is supplied in the morning capsule, and iron and copper are provided in the evening capsule. Furthermore, simultaneous administration of iron and vitamin C induces free-radical formation through a pro-oxidant mechanism, resulting in DNA damage,¹³ increased lipid peroxidation,¹⁴ and cell damage.¹⁵ Therefore, vitamin C and iron are separated into morning and evening capsules, respectively. Green tea extract, a source of polyphenols, is part of the morning capsule, whereas copper and iron are included in the evening capsule. This is important because polyphenol can chelate metal ions, such as iron and copper, thereby reducing the quantity of these ions before they can be incorporated into proteins.¹⁶ It is important not to supply tea extract (containing caffeine) in the evening, so as to prevent sleep troubles due to caffeine. Tea extract is known to have antioxidant effects exhibited by scavenging radicals and oxidants,¹⁷ by inhibition of redox-sensitive transcription factors,¹⁸ and by inhibition of pro-oxidant enzymes.¹⁹

Flavonoid components of grapes are important for their functions in thermogenesis and antioxidative activity.²⁰ All vitamin B components (B₂, B₅, B₆, B₈), together with shark cartilage and fish oil, have, aside from their antioxidative capacities, nutritional functions that help to improve skin, nail, and hair cell regeneration.

Ingredients of INVERSION Femme improve aging-dependent changes in beauty and have positive effects on health. Weight reduction, together with intake of biotin and chromium, reduces the risk of diabetes.²¹ Antioxidants are important for repairing DNA and for minimizing the risk of environmentally induced cancer. Catechins and flavonoids, components of green tea, reduce the incidence of obesity, diabetes, and cardiovascular disease.²² The effect of flavonoids is probably due to induced endothelium-dependent vasodilatation and to inhibition of low-density lipoprotein cholesterol oxidation.²⁰

INVERSION Femme is more than just a slimming product. It is designed to improve many of the signs of aging, such as appearance of the skin and nails, hair loss, and the tendency toward increased size (eg, waist, thighs). Results of the clinical trials reported here and positive feedback from many consumers in more than 30 countries clearly indicate that INVERSION Femme is a potent, easy-to-take nutritional supplement that has statistically significant positive effects on skin appearance, nail properties, hair loss, and slimming. To substantiate these results, well-designed placebo-controlled studies are required.

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REFERENCES

1. Segger D, Schönla F. Supplementation with Evelle improves skin smoothness and elasticity in a double-blind, placebo-controlled study with 62 women. *J Dermatolog Treat*. 2004;15:222-226.
2. Jacquet A. Evaluation des amincissants: une méthode très simple. *Parfums Cosmétiques Arômes*. 1992;108:56-58.
3. Kurban RS, Bhawan J. Histologic changes in skin associated with aging. *J Dermatol Surg Oncol*. 1990;16:908-914.
4. Dulloo AG. A role for suppressed skeletal muscle thermogenesis in pathways from weight fluctuations to the insulin resistance syndrome. *Acta Physiol Scand*. 2005;184:295-307.
5. Shixian Q, VanCrey B, Shi J, Kakuda Y, Jiang Y. Green tea extract thermogenesis-induced weight loss by epigallocatechin gallate inhibition of catechol-O-methyltransferase. *J Med Food*. 2006;9:451-458.
6. Bureau JP, Ginouves P, Guilbaud J, Roux ME. Essential oils and low-intensity electromagnetic pulses in the treatment of androgen-dependent alopecia. *Adv Ther*. 2003;20:220-229.
7. Trost LB, Bergfeld WF, Calogeras E. The diagnosis and treatment of iron deficiency and its potential relationship to hair loss. *J Am Acad Dermatol*. 2006;54:824-844.
8. Rushton DH. Nutritional factors and hair loss. *Clin Exp Dermatol*. 2002;27:396-404.
9. Floersheim GL. Treatment of brittle fingernails with biotin [in German]. *Z Hautkr*. 1989;64:41-48.
10. Hochman LG, Scher RK, Meyerson MS. Brittle nails: response to daily biotin supplementation. *Cutis*. 1993;51:303-305.

11. Colombo VE, Gerber F, Bronhofer M, Floersheim GL. Treatment of brittle fingernails and onychoschizia with biotin: scanning electron microscopy. *J Am Acad Dermatol*. 1990;23:1127-1132.
12. Arredondo M, Martinez R, Nunez MT, Ruz M, Olivares M. Inhibition of iron and copper uptake by iron, copper and zinc. *Biol Res*. 2006;39:95-102.
13. Rehman A, Collis CS, Yang M, et al. The effects of iron and vitamin C co-supplementation on oxidative damage to DNA in healthy volunteers. *Biochem Biophys Res Commun*. 1998;246:293-298.
14. Lachili B, Hininger I, Faure H, et al. Increased lipid peroxidation in pregnant women after iron and vitamin C supplementation. *Biol Trace Elem Res*. 2001;83:103-110.
15. Kang SA, Jang YJ, Park H. In vivo dual effects of vitamin C on paraquat-induced lung damage: dependence on released metals from the damaged tissue. *Free Radic Res*. 1998;28:93-107.
16. Frei B, Higdon JV. Antioxidant activity of tea polyphenols in vivo: evidence from animal studies. *J Nutr*. 2003;133:3275S-3284S.
17. Nakagawa T, Yokozawa T. Direct scavenging of nitric oxide and superoxide by green tea. *Food Chem Toxicol*. 2002;40:1745-1750.
18. Yang CS, Maliakal P, Meng X. Inhibition of carcinogenesis by tea. *Annu Rev Pharmacol Toxicol*. 2002;42:25-54.
19. Chan MM, Fong D, Ho CT, Huang HI. Inhibition of inducible nitric oxide synthase gene expression and enzyme activity by epigallocatechin gallate, a natural product from green tea. *Biochem Pharmacol*. 1997;54:1281-1286.
20. Stein JH, Keevil JG, Wiebe DA, Aeschlimann S, Folts JD. Purple grape juice improves endothelial function and reduces the susceptibility of LDL cholesterol to oxidation in patients with coronary artery disease. *Circulation*. 1999;100:1050-1055.
21. McCarty MF. cGMP may have trophic effects on beta cell function comparable to those of cAMP, implying a role for high-dose biotin in prevention/treatment of diabetes. *Med Hypotheses*. 2006; 66:323-328.
22. Lu H, Meng X, Yang CS. Enzymology of methylation of tea catechins and inhibition of catechol-O-methyltransferase by (-)-epigallocatechin gallate. *Drug Metab Dispos*. 2003;31:572-579.