Cosmetic products for cellulite: is their efficacy proved?

Abstract
In spite the high number of cellulite reduction products available on the market, relatively few scientific papers on the efficacy of these treatments have been published. The aim of this study was to investigate the efficacy of cosmetic products in cellulite reduction. We reviewed all the literature on this issue using a comprehensive search of the Medline/PubMed and Embase databases and provided a summary meta-analytic estimate of the efficacy of cosmetic products in reducing thigh circumference. Twenty-two trials were identified, with sample size ranging from 12 to 134 volunteers. Most of them included women only, were placebo-controlled, and had an intra-patients design. Eight studies were considered in the meta-analysis. The mean thigh circumference reduction (from baseline) in the treated group was significantly higher than in the control group (mean difference = -0.47 cm), pointing to a moderate efficacy.

INTRODUCTION
Among the potential treatments for improving the appearance of cellulite (e.g., pharmacological treatments, non-invasive devices, and surgery), topical products are today the most commonly used, since they represent an easy and non-invasive technique. In spite the huge market for topical treatments, relatively few scientific publications reported results from studies evaluating their safety and efficacy. Since the efficacy testing of cosmetic products is a key point to support efficacy claims, it is important to produce and publish the relative documentation, better if in peer-reviewed indexed scientific journals (1-3).

Due to the large differences in protocols of scientific researches for testing efficacy of products, an Italian Interdisciplinary Group for the standardization of efficacy tests on cosmetic products has recently published a consensus paper (4). The aim of that paper was to define statements for making studies reliable, reproducible and safe, following the principles of good clinical practice and a well-designed and scientifically valid methodology.

To date, there are several published papers testing a specific cosmetic product mainly with topical agents as xanthenes, retinoids and several types of botanical extracts (3), but most of them are based on a limited number of subjects with consequently low power to detect a difference, if any. In order to make a critical overview and a summary estimate of the efficacy of cosmetic products in cellulite reduction, we performed a systematic review and meta-analysis of published data in humans following the PRISMA Statement to improve accuracy, reliability and transparency of the research (5).

MATERIAL AND METHODS
Systematic review. This systematic review followed the PRISMA guidelines for reporting systematic reviews and meta-analyses (5). A detailed description of the methods has been previously reported (3). In brief, eligible for inclusion in our study were clinical trials evaluating the efficacy of a cosmetic treatment for cellulite improvement. Authors carried out the literature search in the Medline/PubMed database and Embase from inception date to September 2014. The following search string was used for PubMed: “cellulite OR gynoid lipodystrophy OR adiposis edematous OR (dermopanniculosis AND deformans) OR (status AND protrusus AND cutis)”, and a similar combination of terms was used for Embase. After excluding articles not in English and conference abstracts, two investigators (CG and FT) independently screened titles and abstracts to identify potentially relevant articles. We finally collected 22 articles from which the two review team members abstracted a number of information in a standard format (6-27). A flow chart of the procedure to select studies is shown in Figure 1.

Meta-analysis. For the meta-analysis, we considered as outcome measure the reduction in the thigh circumference,
i.e., the most frequently reported outcome. Studies not providing data on the selected outcome, as well as those without a control group were excluded from the meta-analysis. The current meta-analysis was therefore based on eight controlled trials (Figure 1) providing the mean reductions of thigh circumference in the treatment group and in the control group with their standard deviations (SDs), or information for their calculation (11, 12, 14, 18, 20, 21, 24, 25). Study-level imputation of SDs was performed when the SDs were not available for a single study, using the arithmetic mean of the SDs from the other studies by treatment/control arms. We used the difference between the mean value of thigh circumference reduction in the active and placebo groups (i.e., mean difference, MD) as the measure of treatment effect. Summary estimates of the weighted MD were calculated through random-effects models. Heterogeneity among studies was evaluated by means of the chi-squared test (28), and the potential inconsistency was quantified through the I² statistic (29). Results were presented in a forest plot, overall and by study quality. Placebo-controlled, double-blind studies with randomization or an intra-patient design were classified as study with “high quality trial design,” otherwise as study with “low quality trial design”. Publication bias was assessed by visual inspection of funnel plot (30), and by the Egger’s and Begg’s test (31).

All the statistical analyses were performed using STATA software (version 11; StataCorp, College Station, TX, USA).

RESULTS

The first study was published at the end of the ‘80s by Greenway et al, and reported a better improvements in thighs girth in obese women treated with four different cream formulations than in those treated with placebo (15). After that, 21 clinical trials were published, the sample size of which ranged from 12 to 134 volunteers. Most of the studies included only women, generally of middle age (the mean age was between 30 and 40 years for most studies), and with a certain grade of cellulite (mainly moderate-severe cellulite). Two studies enrolled exclusively obese or overweight patients (15, 17), whereas the majority of other studies included normal weight or slight overweight patients. Nineteen out of 22 studies were controlled trials, and in most of them the control group consisted in subjects using an inactive placebo cream. Four studies had a non-intervention control group, while, in another study, the control group consisted of subjects receiving inactive pills. Among controlled trials, 5 were based on a parallel group design (3 with randomization) and 14 had an intra-patient design, with subjects using both the active cream (e.g., on the right leg) and the placebo (e.g., on the left leg). Six studies tested cosmetic creams containing xanthenes only, five studies containing herbals only, and two studies containing retinol only. Formulations of cosmetic creams used in the other studies combined different active ingredients, and usually included xanthenes. In most studies the frequency of treatment application was twice per day, whereas in 6 studies subjects applied topical treatments once per day and in one study three- or four-times per week. The duration of the treatment ranged from 28/30 days to 6 months, with 6 studies lasting for at least 3 months. Improvement of cellulite during the study and at the end of it was generally performed by means of instrumental evaluation (such as circumference of thighs, hips, buttocks and/or abdomen, plicometry, and ultrasound analysis), clinical observation of cellulite appearance, and patient self-evaluation from questionnaires.

A detailed description of the studies investigating the efficacy of cosmetic products in improving cellulite has been reported previously (3). Here we gave details on the most recent study on the issue that was not considered in the previous review. Dupont et al. reported results from a double-blind, randomized, placebo-controlled clinical trial testing the efficacy of a multi-active integral topical gel versus a vehicle placebo gel on 44 healthy women (25–55 years old) with a normal to slightly overweight and slight to moderate cellulite on their thighs, buttocks and/or hips (12). The test product formula combined cosmetic ingredients addressing skin aging and cellulite, including caffeine, N. nucifera extract, carnitine, retinol, and escin. Twenty-two women were randomly assigned to the active product group, while the other 22 formed the placebo group. Women applied the active or placebo gel on their hips, stomach, buttocks, and thighs, twice daily for 3 months. Clinical assessment of skin tonicity, “orange peel” and “stubborn” cellulite appearance, and circumference measurements were conducted on hips, buttocks and thighs (and abdomen for circumference measurement only) at baseline and after 4, 8 and 12 weeks. Women were also asked to complete qualitative surveys for cellulite self-evaluation after 2, 4 and 12 weeks of product application. By the end of the clinical trial, considering all descriptors and sites combined, improvement in cellulite condition emerged on average in 81 percent of women using the active cream and in 32 percent of women using the placebo. Skin tonicity, orange-peel appearance, and stubborn cellulite were significantly improved (P<0.05) over placebo, on all studied areas (buttocks, thighs, and hips). In the active treatment group, compared to baseline, skin tonicity improved on average by +41 percent for buttocks, +35 percent for hips, and +31 percent for thighs; orange peel appearance was reduced on average by −25 percent for buttocks, −22 percent for hips, and −22 percent for thighs; and stubborn cellulite was reduced on average by −19 percent for buttocks, −24 percent for hips, and −22 percent for thighs. Placebo treatment resulted in limited improvement of skin tonicity, orange-peel appearance, and stubborn cellulite. Treatment with the active gel was significantly better performing than placebo in reducing the circumference of the abdomen (-1.1 cm for the active cream vs -0.4 cm for the placebo cream) and thighs (-0.8 cm for the active cream vs -0.3 cm for the placebo cream). The difference between active and placebo gels in reducing hips and buttocks circumferences was not significant (-0.8 for the active cream vs -0.4 for the placebo cream). There was no difference in efficacy perception between the active product and the placebo at week 2; slightly differences emerged at week 4, and were confirmed at study end.

Meta-analysis

Thigh circumference changes from baseline ranged between -2.16 cm to +0.66 cm (mean = -0.51 cm; SD=0.80 cm) in the active groups and between -0.65 cm to +1.26 cm (mean = -0.18 cm; SD=0.57 cm) in the placebo one. The forest plot in Figure 2 shows the study specific and the pooled efficacy of cosmetic creams for cellulite improvement vs. control, using thigh circumference reduction as the outcome measure. Overall, the pooled MD was -0.47 (95 percent confidence interval, CI, -0.81, -0.12), with significant heterogeneity among studies (p<0.001). Studies with high quality trial design were
<table>
<thead>
<tr>
<th>First author, year</th>
<th>Study type; No. of subjects in the trial</th>
<th>Grade of cellulite/weight at baseline</th>
<th>Active cream type(s)</th>
<th>Application (Dose Duration of intervention)</th>
<th>Outcome measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greenway and Bayley, 1987 (15)</td>
<td>Trial CT (P-C) 23 W*</td>
<td>Obese women that wished to lose weight</td>
<td>Product I: Cream with colforsin (forskolin), aminophylline and yohimbine (n=5) Product II: Yohimbine cream (n=4) Product III: Colforsin cream (n=4) Product IV: Aminophylline cream (n=5)</td>
<td>Five times-week for 4 weeks</td>
<td>Circumference (Thighs)</td>
</tr>
<tr>
<td>Arzt an Danner, 1998 (7)</td>
<td>Trail 12 (M+W)</td>
<td></td>
<td>2% aminophylline/theophylline gel</td>
<td>Twice-day for 3 months</td>
<td>Circumference (Thighs, waist and hips) Ultrasound of the skin in the area of lateral thighs Aminophylline serum levels, lipid profiles and blood glucose levels</td>
</tr>
<tr>
<td>Busogin et al. 1998 (10)</td>
<td>Trial 89 W (Group I: monotherapy; Product I; Group II: triple therapy; Product II)</td>
<td>Clinical diagnosis of cellulite</td>
<td>Product I: Cream with active ingredients of botanical extracts Product II: Triple therapy with alternate application according to a specific schedule of: 1) cream with caffeine and the same botanical extracts in Product I, 2) a mud with the same botanical extracts in Product I and 3) a serum with the same botanical extracts in Product I</td>
<td>Once-day for 1 month</td>
<td>Circumference (Thigh) Ultrasound for fat tissue evaluation Clinical assessment Self-evaluation survey</td>
</tr>
<tr>
<td>Epstein et al., 1997 (13)</td>
<td>Trail CT 23 W**</td>
<td>Normal body weight</td>
<td>Skinny Dip™-Aminophylline</td>
<td>Twice-day for 8 weeks</td>
<td>Circumference (Thigh, abdomen) Caliper (inner and outer thigh, abdomen)</td>
</tr>
<tr>
<td>Coils et al., 1999 (11)</td>
<td>Trial CT (P-C) 20 W</td>
<td>Cellulite of the thighs and buttocks</td>
<td>2% aminophylline with 10% glycolic acid</td>
<td>Twice-day for 12 weeks</td>
<td>Circumference (Thigh) Ultrasound measurements of thigh subcutaneous fat depth Clinical evaluation of cellulite Self-evaluation survey</td>
</tr>
<tr>
<td>Kligman et al., 1999 (17)</td>
<td>Trial CT (P-C) 20 W</td>
<td>Slightly to moderately overweight; moderate degrees of cellulite</td>
<td>0.3% retinoic formulation</td>
<td>Twice-day (~3 mg/cm² per application) for 6 months</td>
<td>Laser Doppler velocimetry Ultrasound measurements of thickness among 5 subjects only Clinical evaluation of improvement with a global scale (none, fair, good, excellent) Self-evaluation survey</td>
</tr>
<tr>
<td>Lesser et al., 1999 (18)</td>
<td>Trial CT (P-C) 17 W</td>
<td>Slight to moderate amounts of subcutaneous adipose tissue in the hips, thighs, abdomen or upper posterior arm area</td>
<td>Liposome-encapsulated caffeine-based formulations Formulation I: 2% caffeine (n=23) Formulation II: 1% caffeine (n=18)</td>
<td>Twice-day for 2 months</td>
<td>Circumference (Thighs, abdomen) Caliper, triceps, lateral thigh, posterior thigh, abdomen and hips Dermatological evaluation (cellulite appearance, skin tone and skin tension)</td>
</tr>
<tr>
<td>Perin et al., 2000 (22)</td>
<td>Trial CT (P-C) 17 W</td>
<td>BMI: 18-25 Kg/m² (mean 21.2 Kg/m²)</td>
<td>Stimming product</td>
<td>Twice-day for 2 months</td>
<td>Ultrasound measurements of thickness of subcutaneous adipose tissue Photographing assessment of cellulite intensity Self-evaluation survey</td>
</tr>
<tr>
<td>Pélèrand-Franchinont et al., 2000 (23)</td>
<td>Trial CT (P-C) 15 W</td>
<td>Mild cellulite</td>
<td>Retinol Actif Pure®</td>
<td>Once-day for 6 months</td>
<td>Ultrasound measurement of dermo-epidermal thickness Tensile properties of skin (i.e., biologic elasticity, differential tension, elastic function, maximum deformation, relative elastic recovery, viscoelastic ratio)</td>
</tr>
<tr>
<td>Berlin et al., 2001 (9)</td>
<td>Trial CT (P-C) 6 W</td>
<td>BMI: 20-25 Kg/m² moderate cellulite in the thighs</td>
<td>Product containing retinol, caffeine, nusogenecin extract and alcohol</td>
<td>Twice-day for 3 months</td>
<td>Micro-relief of the skin of the external face of the thighs (evaluation of orange peel effect) 3D ultrasound imaging for the evaluation of structure of the dermis and hypodermis Mechanical characteristics of the skin (maximum extensibility of the skin, assent vertical extensibility, viscoelasticity, immediate retraction, total retraction, biological elasticity, viscoelasticity rate, recovery rate, residual deformation) Laser Doppler flowmetry to evaluate the skin perfusion</td>
</tr>
<tr>
<td>Jouandou et al., 2004 (18)</td>
<td>Study I: Trial CT (P-C) 24 W</td>
<td>Study II: Trial CT (P-C) 26 W</td>
<td>Study I: BMI: 21-26 Kg/m², fat percentage with respect to body weight between 28 and 35%</td>
<td>Study I: Twice-day for 28 days Study II: Twice-day for 56 days</td>
<td>Study I: Biomechanical properties of thigh skin (i.e., skin elasticity, skin tone) Study II: Circumference of abdomen</td>
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</table>
Table 1. Main characteristics of efficacy studies of cellulite reduction products on healthy volunteers.

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Intervention</th>
<th>Methodology</th>
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<tbody>
<tr>
<td>Rao et al., 2005 (24)</td>
<td>Trail CT (P-C)</td>
<td>Cellulite score at least III of IV</td>
<td>Spa MD Anti-Cellulite Cream&lt;sup&gt;TM&lt;/sup&gt; Active ingredients: pipiper nigrum, citrus aurantium dulcis, zinger officinalis, malpighia sinensis, cinnamomum cassia, capsicum annuum resin, caffeine</td>
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<td></td>
<td>l-P 40 W</td>
<td></td>
<td>Once-day for 4 weeks Circumference (lower and upper thigh) Clinical evaluation (visual improvement of cellulite) Self-evaluation survey</td>
</tr>
<tr>
<td>Lupi et al., 2007 (19)</td>
<td>Trail CT</td>
<td>BMI: 20-24 Kg/m², clinical apparent cellulite</td>
<td>7% caffeine solution Twice-day for 1 month % of patients with reduction/size of thigh and hip circumferences % of changes in perivascular dermis edema (functional capillary density, diameter of the dermic capilla, capillary diameter) Skin roughness evaluated with a camera Self-evaluation survey</td>
</tr>
<tr>
<td></td>
<td>l-P 134 W</td>
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<tr>
<td>Bazela et al., 2011 (6)</td>
<td>Trail 25 W</td>
<td>Grade 2, 3 of cellulite on thighs</td>
<td>Cream-gel with Hydrolyzed Cucurbita Pepo, L-arginine, Vaccumum Macaropora, Citrus Aurantium Dulcis</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Once-day for 4 weeks Ultrasound measurements of the thickness of the subcutaneous tissue Skin moisture evaluated with corneometry Skin roughness evaluated with a camera Self-evaluation survey</td>
</tr>
<tr>
<td>Ercolani et al., 2011 (14)</td>
<td>Trail CT</td>
<td>BMI: 20-27 Kg/m², cellulite score ≥2 of The L’Oréal Cellulite Chart&lt;sup&gt;®&lt;/sup&gt; (scoring from 0 to 4)</td>
<td>5% caffeine and a flavonoid-rich Noturbo nuxiaceas extract Twice-day for 4 weeks Circumference (upper part of the thighs) Cellulite clinical score without pinching and after pinching Skin tinctility, using the Dermal Torquemeter Volume reconstruction of the thigh, hip and buttock</td>
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<td></td>
<td>l-P 50 W</td>
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<tr>
<td>Nicolet et al., 2011 (20)</td>
<td>Trail CT</td>
<td>Cellulite diagnosis (mean stage of cellulite 2.5 in T-G and 2.7 in C-G)</td>
<td>Cosmetic preparation containing Hydrolyzed Cucurbita Pepo, Vaccumum Macaropora, Citrus Aurantium Dulcis, L- arginatine Two-days for 30 days Classical ultrasound measurements of thickness of subcutaneous tissue and dermis High-Frequency ultrasound measurements of thickness of epidermis, dermis, length of subcutaneous tissue fascide, surface area, echogenicity, presence fatulence of edemas Clinical evaluation of cellulite</td>
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<td></td>
<td>61 W</td>
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<tr>
<td>Roux et al., 2011 (25)</td>
<td>Trail CT (P-C)</td>
<td>BMI: 20-26 Kg/m²; grade 2 or 3 (Cum’s classification) of orange peel on the thighs, hips, buttocks and stomach</td>
<td>Cream containing tetrohydroxprypyl ethylenediamine, caffeine, caratine, forsinilin, retinol Twice-day or 12 weeks Circumference (abdomen, thighs, hips, buttocks, waist) Skin plastoelasticity (inner thigh) Contact thermography (assessment of stage of cellulite) Ultrasound measurement (outer thigh) Spectrophotometric analysis (evaluation of surface microcirculation) Clinical evaluation of cellulite</td>
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<tr>
<td></td>
<td>l-P 78 W</td>
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<tr>
<td>Sparvigna et al., 2011 (25)</td>
<td>Trail CT (P-C)</td>
<td>Fat accumulation and/or slight to moderate edematous-fibrosclerotic panniculopathy in the lower limbs</td>
<td>Active cream (Vinazadine 9.25% + Ginko biloba 0.5%, Eson 1%) Twice-day for 4 weeks Circumference of thigh (upper, median and lower third) Skin plastoelasticity (inner thigh) Contact thermography (assessment of stage of cellulite) Ultrasound measurement (outer thigh) Spectrophotometric analysis (evaluation of surface microcirculation) Clinical evaluation of cellulite</td>
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<td></td>
<td>l-P 20 W</td>
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<tr>
<td>Vogelgesang et al., 2011 (27)</td>
<td>Trail CT (P-C)</td>
<td>Grade 3.5-5 of cellulite severity on a dermatological scoring scale (from 0 to 9)</td>
<td>Product I: 3% sulfa-carboxibose Product II: 3% sulfa-carboxibose + 3% caffeine Product III: 3% caffeine Twice-day for 8 weeks Circumference (thigh) Clinician’s evaluation of cellulite appearance with a scoring 10-grade scale Thighs volume (using fringe projection techniques)</td>
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<tr>
<td></td>
<td>l-P 50 W</td>
<td>(Group I: Product I vs placebo, Group II: Product II vs Product III)</td>
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<tr>
<td>Al-Bader et al., 2012 (9)</td>
<td>Trail CT (P-C)</td>
<td>Grade 3.5-5 of cellulite severity on a dermatological scoring scale (from 0 to 9)</td>
<td>Complex formulation with Fumuslanta Jumbricola, Fucus vesiculosus, wetahe, conjugated linoleic acid, glucoline plus a set of vehicle ingredients Once-day for 12 weeks Clinical evaluation of cellulite appearance (9-grade scale) Ultrasound imaging for fat tissue thickness evaluation</td>
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<td>l-P 35 W</td>
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</tr>
<tr>
<td>Perez Macalado et al., 2012 (21)</td>
<td>Trail CT (P-C)</td>
<td>BMI: 18.5-29.5 Kg/m² (mean 22.9 in T-G and 20.6 in C-G), localized android and/or gynoid adiposities</td>
<td>Cryotherapy with camphor and menthol gel Three- or four times-week, one- or two-day interval between application. Average of 8-45 applications Circumference (body perimeter: arm, waist, hip, abdomen and thigh) Cutaneous folds (thick, fat, subcuticular, medial axillary, pectoral, supraclavic, abdominal, femoral) Body fat percentage (Trispolar bioelectrical impedance) Body self-image scale</td>
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<td></td>
<td>l-P 36 W</td>
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<tr>
<td>Duong et al., 2014 (12)</td>
<td>Trail CT</td>
<td>BMI: 20.0 and 28.0 kg m⁻²; slight to moderate cellulite on thighs, buttocks, and/or hips</td>
<td>Gel with several cosmetic active ingredients (total concentration of cosmetic active ingredients is 25%) twice daily for 3 months Circumference measurements (abdomen, hips/buttocks, and both thighs) Skin tinctility, orange peel, aspect, and stubborn cellulite</td>
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<td></td>
<td>44 W</td>
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***The study enrolled 28 patients and divided them in three groups: liposonelor injections, one topical cream with a complex formulation and a topical cream with colforsin, yohimbine or aminophylline alone. Since the trial was intra-patient, in this article we considered only the groups treated with topical creams versus placebo among 23 women. **The study enrolled 69 patients and divided them into three groups: aminophylline cream vs placebo, endermologie vs placebo and both treatments vs placebo. Since the trial was intra-patient, in this article we considered only the first group of aminophylline cream versus placebo among 23 women.

*W* women; *y* years; *l-P* intra-patient; *RR* not reported; *P* placebo controlled; *T-G* treated group; *C-G* controlled group; *WHR* waist-to-hip ratio.
broadly homogeneous ($p=0.545$, $I^2=0.0$ percent) and, pooled together, gave a summary MD of -0.29 ($95\% CI$, -0.51, -0.06). The corresponding pooled estimate from the 3 studies with low quality trial design was -0.88 (95 percent CI, -1.94, 0.18), with high heterogeneity. The exclusion of the study by Mlosek et al. (20), with the greater difference in thigh circumference reduction between the active and the placebo arms, gave a summary MD of -0.28 (95 percent CI, -0.47, -0.10), with no longer significant heterogeneity ($p=0.619$, $I^2=0.0$ percent). No presence of publication bias was detected by means of visual inspection of funnel plot and by Egger’s ($p=0.291$) and Begg’s tests ($p=0.677$).

**DISCUSSION**

Using a meta-analytic approach, we found a little, but significant, effect of cosmetic products in reducing circumference thigh compared to placebo. The summary estimate, however, was based on 8 out of the 22 published articles we considered in the systematic review, i.e., articles reporting as outcome measure the reduction in thigh circumference, that considered a control group and provided the quantitative information needed for conducting the meta-analysis. This underlines the need for studies with standardized and rigorous methodologies in designing and conducting the research, measuring the outcome, and reporting findings (e.g., providing measures of variability together with measures of the main effect). In particular, there are various proposed methods of assessment for cellulite, such as visual assessment, body circumference, thigh roughness, dermal-subcutaneous interface length and subcutaneous thickness, skin elasticity, but there is a lack of consensus in identifying the gold standard criteria for efficacy trials. Moreover, beside English articles in online bibliographic citation databases (e.g., PubMed, Embase), a number of investigations were published in languages other than English, and/or in the form of conference abstracts (and therefore with too limited data), and/or in journal not indexed in Medline. We used a standardized, systematic, meta-analytic approach, as that proposed by the PRISMA, to summarize scientific evidence on topical treatments for cellulite, and we were able to consider only a small part of the data on the issue.

Most topical preparations contained several pharmacological agents used for the improvement of cellulite, including methylxanthines, retinoids, lactic acid and herbal extracts, alone or in combination. These agents exert their anti-cellulite effects by several biological mechanisms.

The methylxanthines such as caffeine, aminophylline, and theophylline are the main category with documented action in the treatment of cellulite. The most used methylxanthine is caffeine. It can penetrate the skin easily and stimulate the lipolysis by several ways. It inhibits the phosphodiesterase activity leading to cAMP accumulation in the adipocyte, responsible of the increment of the degradation of the triglycerides into free acids and glycerol (27). Caffeine may also effect the secretion of catecholamines, responsible of adenylylcyclase activation and cAMP secretion (32). Caffeine can also accelerate the drainage of lymph system in fatty tissue by removing toxins and accumulated fat during the lipolysis process, and it has a simulating effect on the cutaneous microcirculation (33). Herbal treatments usually contain a complex mixture of numerous botanical extracts. The main anti-cellulite mechanism attributed to the substances present in herbal treatments seems to be related to the improvement in microcirculation by reducing blood viscosity, inhibiting the platelet-activating factor, increasing red blood cell deformability, diminishing vascular permeability and improving vascular wall tone. These herbal treatments include plants such as Ginkgo biloba, also rich in flavonoids, Centella asiatica, Ruscus aculeatus, Carica papaya (34). Topical retinoic and related vitamin A derivates have been also used as topical cellulite treatments. The anti-cellulite effects of the retinoids maybe related to the increase of dermal collagen thickness and an improvement of the contour of elastic fibres. Retinol can act as an anti-adipogenic agent by inhibiting the differentiation of human adipocyte precursor cells by reducing the expression of the ob gene (35). In our critical review we were not able to identify the efficacy of a specific active agent or which is the most efficient one, since most of the active creams contained several pharmacological agents. However, caffeine is present in almost all formulations and the anti-cellulite action could be the result of the synergistic action of the different agents.

**CONCLUSIONS**

In conclusion, this systematic review summarized scientific available evidence on the efficacy of cellulite reduction products and found a moderate efficacy in thigh circumference reduction. Due to the paucity of


Can Nature help us to develop future sun protection strategies?
The first sunscreens protected against sun burning and were essentially UVB protectants with low factors that allowed easy tanning of the skin.

Modern sunscreen products may still provide highly heterogeneous attenuation of the sun’s rays not necessarily consistent with the quality of electromagnetic radiation experienced in nature. As an industry we have been driven by the quantity of protection as indicated by the SPF and not necessarily the quality of protection. A level of UVA protection is now a requirement for most markets worldwide, but is this sufficient in terms of quality and quantity of broadband protection? Are there other wavelengths that we should consider in our protection strategies? What does natural protection tell us about the biological need?

The theme of the conference this year is ‘inspirations from nature’ where we will explore and re-examine sun product development strategies in terms of quality of protection, natural substances and human behaviour.

In addition, internationally renowned expert speakers have been invited to give an update on sun care technology, testing and worldwide regulations affecting the development, testing, and promotion of sun products.

**Speakers & topics announced so far:**

**Conference chairman:** Dr Jack Ferguson, Skinovations Ltd, UK

**Keynote:** Spectral homeostasis – a property of future sunscreens?
Utii Osterwalder, BASF, Germany

**Sunshine protection: what are we trying to achieve?**
Dr Richard Weller, Edinburgh University, UK

**US sunscreen regulation and the OTC drug review**
Jennifer Rempe, Energizer Personal Care, USA

**Natural photoprotection afforded by the human body – the contributions of melanin, hair and shadow**
Professor Paul Matts, Proctor & Gamble (HABC) Ltd, UK

**Spectral variations of solar UV due to natural and built factors**
Professor Alfo Parisi, Faculty of Health, Engineering and Sciences, University of Southern Queensland, Australia

**Sun product regulations: global update**
Debra Redbourn, Dr Cosmetic Regulations, UK

**Natural or efficient – does nature compromise science?**
John Staton, Dermaltest Pty Ltd, Australia

**In silico, in vitro and ex vivo studies identified strong UV-protective effects of a phytocompound**
Dr Christina Osterlund, Oriflame Cosmetics AB, Sweden

**A global approach to sun protection – UV, visible, IR**
Dr Marc Pissavini, Cty Lancaster, Monaco

**Global trends in sun care**
Florence Bernardin, Information & Inspiration, France

**Suntanning with sunscreens: a comparison with sunburn tanning**
Utii Osterwalder, BASF, Germany

**Is photoprotection necessary for ethnic skin types?**
Dr J Nash, The Procter & Gamble Company, USA

**Who should attend?** This will be an important meeting for all professionals interested in sun protection, including R&D managers and directors, dermatologists, marketing and product managers, retailers of sun care products, regulatory affairs personnel, formulation chemists, product valuation scientists, research scientists, raw materials suppliers and suppliers of sun product testing apparatus.

Speakers are of international reputation and include scientists, regulators, sun protection specialists, dermatologists, and product developers from the sun care industry.

**Early booking discount available until 31 January 2015**

**For booking information go to www.summit-events.com**