ABSTRACT

PART I: MARKET RESEARCH AND CONSUMER BEHAVIOUR

1.0 INTRODUCTION
Cosmetics and Toiletries have become requirements of daily life. Over the past few years, cosmetic science has taken quantum leap in sophistication, improved cosmetic attributes and safety. The most dynamic segment going forward is the anti-aging segment wherein the trend is veering away from products that superficially enhance beauty but have no biological effect to ‘therapeutic’ products so called cosmeceuticals. Today’s elder consumers have a greater interest in personal appearance than their predecessors. The anti-aging products have maintained divergent growth trends in past few years which has led to increased use of new active ingredients including natural products with defined constituents and specific biological effect. The Research & Development department of a company may come up with many new effective products out of which only few could be commercialized and very few would meet with success in the market. Market research thus aims at finding out four things - what to sell, when to sell, where to sell and how to sell. John Kenneth Galbraith has called the consumer as the king. No longer can any manufacturer dump his products on him. The study of consumer behaviour helps to understand - what he wants which leads to product development, where he buys decides the channels of distribution, how he is motivated to buy brings out the sales promotion and advertising plans, how much he buys and at what intervals helps estimate the total demand and ones’ own capacity. A new philosophy is emerging today that rather than placing emphasis on core R & D, it should be on marketing R & D very much in alignment with the quote by Theodore Levitt that “It is not mere R&D but its is marketing R&D”. Today the companies have to decide whether they want to be masters of market or masters of product and technology. In the former one has to understand the needs and wants of the consumer and accordingly has to design an effective product whereas in the latter the products are designed in the laboratory and then marketed which may end up in failures.

This research study was aimed at analysis of consumer awareness about aging and anti-aging therapies and their perception and expectations from anti-aging cosmeceuticals.
Commerically this is a growing market all over the world including India hence the market research and study of consumer behaviour is justified.

2.0 AIMS AND OBJECTIVES
(a) To investigate the most commonly available and sold anti-aging products in the market covering various aspects such as brands, price, category, type, form, package, ingredients, label claims etc.
(b) To evaluate the psychological and physiological behaviour of the consumers in different age groups. The psychological aspects would include the role and importance of appearance in a person’s personality, self-esteem and self-confidence; the desire/preference to look young with the advancement of age. The physiological aspects would include the awareness about aging, premature aging, visible signs of aging, skin wrinkling, and the age from which the care should start to delay skin wrinkling and the body parts where appearance of wrinkles is the major concern.
(c) To find out the awareness of consumers about various anti-aging remedies and to identify the preferences of the consumer pertaining to the source from where they would seek help, the line of treatment which they would prefer, the form of treatment which is most desirable and the most commonly known anti-aging brands.
(d) To understand the perception of consumers about anti-aging cosmeceuticals with respect to their quality, efficacy, the type of effects they exhibit and the time in which the effects are seen.
(e) To evaluate the influence of various factors on the buying behaviour of consumers for anti-aging cosmeceuticals and the preferred place of buying.
(f) To understand the expectations of consumer from anti-aging cosmeceuticals in terms of form of the product, functions of the product, effects of the product and the category of the product etc.
(g) To estimate the likely market size for anti-aging cosmeceuticals and the market growth rate.

3.0 METHODOLOGY
The research methodology included the Primary and Secondary research. Primary research included (i) Market Survey for which all the major shopping malls, cosmetic distribution / retail outlets, chemist’s shop, general stores were visited, the distributors and retailers were interviewed and the products were purchased for comprehending the
information about the most popularly sold type, form, brand etc of anti-aging products.

(ii) **Consumer Research** which included interviewing the samples for which a structured questionnaire was designed and directly administered to the respondents for recording the feedback. The **Sampling Unit** (target population) were the residents of Pune city, the **Sample Frame** (respondents) included consumers of both sexes (male/female) in different age groups, different occupations, different qualifications, different income group. The **Sample Size** (representative population) chosen for this study was 500 from the abovementioned sample frame. The **Sampling Technique** used or the **Sample Type** was Non-probability Stratified sample or Convenience Sample by breaking the population in terms of strata like age, gender, education, income and profession. Secondary research included collecting information by referring to all available sources of published data; this included the print and digital sources.

### 4.0 REVIEW OF LITERATURE

Detailed literature search was carried out for Cosmetics Global Market Scenario, Cosmetics Indian Market Scenario, Market and Product Segmentation, Consumption Pattern and Trends, Demand: Past, Present, Future, Cosmeceutical Global Trends. A brief overview of which is given as:

The cosmetic markets over past few years has shown healthy growth worldwide on account of better market penetration, rising income levels, spread of education which has seen a gradual up gradation of the product quality. Globally the Anti-aging cosmeceutical future trends promise increasingly sophisticated formulations, new challenges to government regulatory agencies as more chemicals with true biological activity are invented and tested, re-evaluation of substances with an assumed good safety profile, direct competence with biotechnology, narrowing of boundaries between pharmaceuticals and cosmetics, better understanding of modern ingredients and assessment techniques. The most influential angle over the coming 5 years will be the links between internal health, beauty and anti-aging\(^1,2,3\).

### 5.0 RESULTS AND ANALYSIS

The **market survey** showed that for anti-aging products there was a huge abundance of Indian and Overseas brands yet the Indian brands were more widely sold because of the substantial price difference between the Indian and overseas brands. The popular anti-aging products sold in the market belonged mainly to the category of naturals wherein the
active ingredients were either of herbal origin or naturally derived. The most common product form was creams and lotions and the most popular package was tubes and jars with Carton as the outer package. The most common category of actives used in the anti-aging products was vitamins and their derivatives, fatty acids and lipids, proteins, herbs and herbal, enzymes, AHAs and their derivatives. The results of consumer research showed that people are very appearance conscience and youthful looks boost their confidence levels. There was good awareness about aging, premature aging, visible signs of aging and the age from which the skin care should be started to delay the signs of aging. The most worrisome sign of aging was wrinkles and the preferred line for anti-aging treatment was Ayurveda. Perception about anti-aging products varied, many people felt that costly anti-aging products are better in quality and more effective than cheaper products whereas a similar percentage of people felt that this is only sometimes true. Majority of the consumers were positive about the functionality and effects of the anti-aging products on their application. The buying decision of consumer for anti-aging products depended mainly on their personal choice and sometimes influenced by TV and friends and most preferred to buy the products from chemist’s shop rather than a general store. The amount which majority of consumers were willing to spend on anti-aging treatments was only up to INR 100 except for very few who were willing to spend up to INR 500. Expectations from anti-aging cosmeceuticals were huge vis. preventing the appearance of new wrinkles, reducing existing wrinkles, making the skin softer, smoother and fairer i.e. serve all the functions of treating, protecting and nourishing the skin.

PART II: EXPERIMENTAL RESEARCH

1.0 INTRODUCTION
Aging is a universal process that began with the origination of life about 3.5 billion years ago. According to the United Nations, the number of people worldwide aged 60 years or older will increase from 1 in 10 currently to 1 in 5 by 2050. The population 80 years or older is projected to increase from 11% of those older than 60 years now to 19% by 2050 and the number of centenarians is expected to increase 15 fold to 2.2 million. The rate of aging of the population is greatest in developing nations, a growing challenge for nations with few health care resources. By 2050, the ratio of people 65 years or older to those aged 15 to 64 years will double in developed nations and triple in developing nations.7,8
This demographic shift compels us to confront the changes associated with aging and various anti-aging therapies.

In any study of aging and aged persons, the largest organ of the body - the skin – deserves its portion of attention. Skin aging is a complex process determined by the genetic endowment of the individual and the environmental factors. The appearance of old skin and the clinical consequences of skin aging have been well known for centuries but it is only in the past 50 years that mechanisms and mediators have been pursued systematically. The most obvious signs of an aging skin are atrophy, laxity, wrinkling, sagging, dryness, yellowness, a multiplicity of pigmented and other blemishes. As per the Modern Perspective skin aging is due to the conjunction of intrinsic factors (chronological aging) and extrinsic factors (fundamentally photo aging) and as per the Ayurvedic Perspective skin aging is due to the imbalance of tridosha (vata, pitta, kapha) and the imbalance of prana, ojas, tejas.

The anti-aging approaches as per Modern Perspective includes prevention of water loss from skin, rebuilding of the cell walls, prevention of collagen and elastin breakdown, reduction of free radical damage, reduction of photo damage. The various anti-aging therapies includes the use of topical Anti-aging cosmeceuticals (containing actives such as Retinoids, Hyaluronic Acid, AHAs, BHAs, Vitamin C, Vitamin E, Flavonoids, Quercetin, Catechins etc), Chemical Peeling, Injectable Agents (Botox, Bovine collagen implant, Fibrel, Autologous fat grafting), Surgical Procedures (Cutaneous surgery, Blepharoplasty, Dermabrasion, Laser Skin Resurfacing. The Ayurvedic anti-aging properties are listed as - anti-aging effect (Vayasthapana), youthful radiance (Varnya), protection from normal wear and tear (Sandhanya), deep healing (Vranropana), enhancing and nurturing (Tvachya), anti-inflammatory (Shothahara), strengthening the skin's metabolic mechanisms (Tvachagnivardhani), maintaining skin health and retarding aging (Tvagrasayana). Anti-aging treatments include herbal preparations, diet, exercise and attention to general mode of life and social behaviour; the concept of anti-aging is embodied in Rasayana (rejuvenation).

Anti-aging Cosmeceuticals is the fastest growing segment of the natural personal care industry. They mainly include specialty ingredients, having drug like benefits and the general mechanism of their action includes - preventing the breakdown of collagen and
elastin by enzyme inhibition action, enhancing healthy cells proliferation and facilitating tissue repair by healing action, reducing free radical damage by antioxidant action, and lightening the skin by depigmentary action. The skin care procedures described in Ayurvedic literatures consist of numerous formula involving herbs and other natural ingredients which were used as external applications in the form of packs, oils, herbal waters, powders etc.\textsuperscript{18}

2.0 AIMS AND OBJECTIVES
(a) To select study materials (herbs/herbal extracts, minerals/metals, fats/oils) based on the rationale described in Modern and Ayurvedic literature for their suitability to be used in formulation of natural anti-aging topical application forms
(b) To evaluate the study materials for their anti-aging mechanism of action by testing them (wherever possible) for anti-oxidant activity and enzyme inhibition activity.
(c) To formulate natural anti-aging topical application creams using the selected raw materials (herbs/herbal extracts, minerals/metals, fats/ oils).
(d) To evaluate the formulated anti-aging creams for their efficacy vis-a-vis a known and popular market brand of anti-wrinkle cream.

3.0 REVIEW OF LITERATURE
In Ayurvedic literature there are records of more than 200 herbs, minerals, fats etc described for skin care. Selection of the study materials was done based on the leads from Ayurvedic and Modern literature for formulating natural topical anti-aging application forms. A brief overview of the activities in the selected raw materials is provided below

**Cow Ghee**\textsuperscript{19, 20} is reported to contain Triglycerides, Free fatty acids, Phospholipids, Sterols, Fat soluble vitamins, and EFAs, alpha-linolenic acid and linoleic acid which contribute to cell integrity. As per Ayurveda ghee improves complexion, personal beauty, youthfulness and the principle of strength (\textit{Ojas}) in the body. It is vitalizing, rejuvenating, increases the quantity of bodily \textit{Kapha} and is refrigerant, emollient and acts as a lubricating moistener. **Flax seed Oil**\textsuperscript{21, 22} is a rich source of EFAs (alpha-linolenic acid and linoleic acid) that can induce wound healing and help in maintaining normal epidermal structure. As per Ayurveda Flax seed oil has properties like \textit{Madhura} (Balances skin pH), \textit{Picchaila} (Lubricous, Prevents dryness of the skin), \textit{Balya} (Improves tensile strength / elasticity of the skin), \textit{Grahi} (Improves moisture holding capacity of
skin), Tavadoshahrit (Removes skin blemishes), Vranahrit (Wound healing) and useful in Vata disorders including dryness, under nourishment, lack of luster / glow. Amalaki (Phyllanthus emblica) Fruit is refrigerant, astringent and a rich source of Vitamin C, a potent antioxidant used for the preventive and protective strategies against the harmful effects of UV radiation to the skin as wrinkling, sunburns etc. As per Ayurveda Amalaki is foremost amongst the anti-aging drugs (vayasthapraṇa), it has properties Rasayna (adaptogenic), ajarā (usefulness in pre-mature aging), ayuṣhrada (prolongation of cell life), sandhāna karaka (cell migration and cell binding), Kantikara (improves complexion). Shorea robusta Resin is used in topical applications for chronic dermatitis, healing cracks, psoriasis, wounds, ulcers, burns, and various other skin problems. As per Ayurveda it has wound healing, anti-inflammatory and anti-microbial property useful in variety of skin diseases. It is also employed as a cream base. Yashada bhasma (Zinc Complex) has wide application in the field of dermatology. The scavenger enzymes of free radicals, superoxide dismutase and glutathione peroxidase are dependent on zinc, copper, manganese and selenium. Zinc influences the synthesis of collagen and hastens wound healing. The UV blocking ability makes ZnO an effective sunscreen. As per Ayurveda the activities of Yashada bhasma are Krimighna (Antimicrobial), Kantikara (Improves Complexion), Rasayana (Skin Healer / Rejuvenator), Grahi (Moisture holding capacity of skin), Sleshmakalasankochakrit (Improves the binding power of the cells of skin soft tissues) and Vranasamsvarodhanam (Improves cell migration, cell regeneration and hastens wound healing).

4.0 MATERIALS AND METHODS

Raw Material Analysis included HPTLC of different solvent extracts, Physicochemical Analysis, EFA Content by GC (Omega-3 and Omega-6 fatty acid composition of samples of Cow Ghee and Flax seed Oil), Phytochemical Investigations of Amalaki fruit extract and Shorea robusta Resin. In-Vitro Studies included (i) Determination of Antioxidant Activity by the following methods - Diphenyl Picryl Hydrazyl (DPPH) Radical Scavenging Activity, Nitric Oxide Radical Scavenging Activity, Oxygen Radical Absorbance Capacity (ORAC) Assay, Reducing Power and In-Vitro Lipid Peroxidation. All the results were presented as IC₅₀ value. (ii) Enzyme Inhibition Activity which included the determination of Elastase Inhibition Activity (by Insoluble Elastin Method
and SANA Method), Hyaluronidase Inhibition Activity and Tyrosinase Inhibition Activity. All the results were presented as IC50 value.

**The Formulation and Development of Topical Anti-aging Application Forms** included following steps - (i) Preparation of Shorea robusta Extract in Flax seed Oil

(ii) Standardization of Shorea robusta Extract - This included the preparation of various batches of the extract and determination of Percentage Yield, HPTLC Pattern, and EFA content by GC

(iii) Formulation of Anti-Aging Creams - Total five variants of emulsion creams (NATAF 001, NATAF 002, NATAF 003, NATAF 004, NATAF 005) were made using the study materials i.e. Cow Ghee, Flax seed Oil, *Amalaki* Fruit Extract, Shorea robusta Resin, *Yashada bhasma*. Preservatives (methyl paraben and propyl paraben) and DM water was present in all the batches.

(iv) Stability Studies of the Formulated Creams - The stability testing conditions and parameters were decided taking into account ICH stability guidelines, WHO stability guidelines and Bureau of Indian Standards. The studies were done in two parts- Quick Assessment Stability Studies, which lasted from 48 hours to 1 Month; Accelerated Stability Studies, which lasted for 6 months.

**In-vivo Studies** included (i) Dermal Irritation/ Corrosion/ Toxicity Studies - According to the updated version of OECD Guidelines 404 (adopted on 24th April 2002) it is described that in case of known substances which are considered to be non-irritating / non-corrosive / non-toxic, no testing is needed. (ii) Wound Healing Activity - Excision and Incision wound models were used to evaluate the wound healing activity of the NATAF creams. The effects of the creams on the rate of wound healing were assessed by the Percentage wound contraction, Hydroxyproline content and Tensile strength / Breaking strength of skin. All the values were expressed as Mean ± SEM. The values were analysed using one-way analysis of variance (ANOVA) followed by Dunnett's *post hoc* multiple comparison test to establish statistical significance. The minimum level of significance was fixed at P< 0.05. (iii) Anti-Wrinkle Activity - The photo aging model (based on the principle that Chronic Ultraviolet-B (UVB) irradiation causes wrinkle formation, decreases skin elasticity, and damages/curls dermal elastic fibers) was used to evaluate anti-wrinkle activity of the NATAF cream. Comparison of skin impression
replicas of the hind limbs of animals and histological examination (elastosis, acanthosis, increased cellularity of dermis, inflammatory cell collections) was done.

5.0 RESULTS AND DISCUSSION

**Raw Material Analysis** which included HPTLC, physicochemical analysis and phytochemical investigation of the study material was done for authentication and for ensuring the quality of the raw materials. In EFA Content (Omega 3 and Omega 6) by GC Cow Ghee showed the presence of Omega 3 as well as Omega 6 fatty acids. Flax seed Oil showed the presence of Alpha Linolenic acid but the amount was much higher compared to Cow ghee.

**In-Vitro Studies** showed strong antioxidant activity of *Amalaki* fruit extract by all the methods viz. DPPH scavenging activity, nitric oxide scavenging activity, ORAC assay, reducing power and lipid per oxidation. The antioxidant activity combats the deleterious effects of free radicals thus can aid in delaying the signs of skin aging. The test samples (*Amalaki* fruit extract, Shorea robusta resin, *Yashada bhasma*) showed no elastase enzyme inhibition indicating that anti-aging effect by means of inhibition of proteolytic action on elastin fiber can’t be exhibited by them. *Amalaki* fruit extract showed hyaluronidase inhibition activity thus it can exhibit anti-aging effect by protecting degradation of hyaluronic acid (a natural high viscosity polymer that fills the space between collagen and elastin fibres in the dermis), it also showed tyrosinase inhibition activity thus can inhibit melanogenesis and can aid in preventing hyperpigmentation associated with photo-aging which is also an important cutaneous manifestation apart from wrinkling.

**Formulation of Topical Anti-aging Application Forms** - The standardized Shorea robusta extract along with other selected study material was used for the preparation of five variants of creams subjected to stability studies. After the variants passed the Quick Assessment Stability Studies they were subjected to Accelerated Stability Conditions (40°C / 75% RH) for 6 months. The parameters studied were found to be more or less constant in almost all the batches of the variants.

**In-Vivo Studies** included Dermal Irritation/ Corrosion/Toxicity Studies - Taking in account the updated version of OECD Guidelines 404 (adopted on 24th April 2002) the
in-vivo testing for formulations for dermal irritation/ corrosion/ toxicity studies was avoided as all the raw materials present there in (Amalaki fruit extract, Shorea robusta resin, Cow ghee, Flax seed oil and Yashada bhasma) are known substances which are considered to be non-irritating / non-corrosive / non-toxic. **Wound Healing Activity** - In excision wound model the group treated with the cream variant NATAF 004, NATAF 005 and the group treated with the popular market brand of anti-aging cream exhibited significant (P< 0.01) increase in the percentage of wound contraction as compared to the control group on Day 7 and Day 9. In the groups treated with the cream variant NATAF 004, NATAF 005 and the group treated with the popular market brand of anti-aging cream, the hydroxyproline content which is indicative of the collagen turnover was significantly higher (P<0.05) compared to the control group. In incision wound model, the skin breaking strength in the group treated with the cream variant NATAF 004, NATAF 005 and the group treated with the popular market brand of anti-aging cream was significantly (P<0.01) greater than that of animals of the control group thus showing enhanced collagen synthesis. All the results propose cream NATAF 004 and NATAF 005 to promote wound-healing activity suggesting it as prospective anti-wrinkle preparation.

In **Antiwrinkle study** the silicon impression of the wrinkles of varied groups were compared and it showed least wrinkles in group treated with the cream variant NATAF 004, NATAF 005 and the group treated with a popular market brand of anti-aging cream when compared to the untreated control group. For histological changes in the skin of different groups of animals conclusions were made mainly based only on incidence and extent of elastosis as other lesions were not conclusive as varying degrees of these lesions were observed in all the groups. The group treated with the cream variant NATAF 004, NATAF 005 and the group treated with a popular market brand of anti-aging cream showed good anti-wrinkle activity with marked reduction in elastosis.

**OVER ALL CONCLUSIONS**

The market research and consumer behaviour study clearly reinforces the fact that skin care has emerged as a dynamic sector over past few years and products, which improve skin health and have anti-aging properties, are growing in demand, and are forecasted to rise world wide. There exists a strong desire to look young and attractive in all the people irrespective of the age, sex, qualification, and profession. People have good awareness about aging, premature aging and various anti-aging therapies; the most preferred line of
treatment being Ayurveda and most preferred product form being creams / lotions. Consumers expect miraculous results on usage of anti-aging cosmeceuticals in a short time period and at a low cost. The experimental study suggests anti-aging activity demonstrated by natural topical application creams comprising of *Yashada bhasma* in Shorea robusta and Flax seed Oil cream base. Its application before exposure to UV radiations shows reduction in elastosis and reduced number of wrinkles, thus suggesting its application in prevention of photo aging. It also showed good wound healing activity indicative of good cell regeneration and collagen synthesis proposing it to be a prospective anti-wrinkle preparation. The antioxidant activity, anti-hyaluronidase and anti-tyrosinase activity of *Amalaki* fruit extract serves as a platform for further studies on mono or polyherbal preparations with possible anti-aging and depigmentary actions. Also the use of Shorea robusta resin as a primary emulsifier in conjugation with other possible synergistic secondary emulsifiers can serve as a strong platform for natural emulsifier systems.

**PUBLICATIONS**

Sharma Datta Hema, Mitra Shankar Kumar and Patwardhan Bhushan. Wound Healing Activity of Topical Application Forms based on Ayurveda. Evidence Based Complementary and Alternative Medicine. (Communicated)

Patwardhan Bhushan, Mitra Shankar Kumar, Paramesh Rangesh and Sharma Datta Hema. Theories and Management of Aging: Modern and Ayurvedic Perspective. Evidence Based Complementary and Alternative Medicine. (Communicated)

Sharma Datta Hema, Mitra Shankar Kumar and Patwardhan Bhushan. Anti-wrinkle Activity of Topical Application Forms based on Ayurveda. (Manuscript)

Sharma Datta Hema, Mitra Shankar Kumar and Patwardhan Bhushan. Anti-oxidant and Enzyme Inhibition Activity of *Amalaki* (*Phyllanthus Emblica*). (Manuscript)
2 Mohnot SR. intecos-cier’s Market Forecasts and Indicators - 2002-2012 the explosive decade In Scanning the Emerging Market of India Size Structure Segmentation - A multi-client study designed and directed by Dr S R Mohnot New Delhi Centre for Industrial & Economic Research Industrial Techno-Economic Services P Ltd, 2003 p 298-311
3 Draelos ZD. New developments in cosmetics and skin care products Adv Dermatol 1997,12 3-17
7 Winker MA. Aging in the 21st Century A call for papers Arch Intern Med 2002 Apr 8, 162(7) 745
9 Passeron T, Ortonne JP. Skin aging and its prevention Presse Med 2003 Sep 27, 32(31) 1474-82
10 Swarnalatha C. Know your skin type Amruth Dec 2004, 8(6) 6-8
11 Kligman L H. Preventing, delaying and repairing photoaged skin Cuts 1998, 41 419
15 Valiathan MS. Procedures for Rejuvenation and Enhancing virility (Rasayana and Vajikarana) In The legacy of Caraka Chennai Chaukhamba Sanskrit Series Office, 2000 p 18-19
17 Fasanmi R. Cosmeceuticals Functional food for the skin Natural Foods Merchandiser 2002, XXIII 92-9
18 Teneralli MJ. Traditional skin care lines improving looks with dietary supp Nutraceuticals World 2004, 7 74-80.
20 Wright S et al.“Essential fatty acids and the skin cosmetic application of research” C&T 1993, 227-232
21 Shaligrama Tailavarga In Shaligramanghantubhushanam Vol 7-8 Mumbai Khemraj Shri krishanadas Prakashan, 1953 p 776-777
22 Holman RT. The slow discovery of the importance of Omega 3 essential fatty acids in human health J Nutr 1998 Feb, 128(2) 427S-433S
23 Sharma L et al. Medicinal plants for skin and hair care Ind J of Trad Know 2003 January, 2 (1) 62-68
24 Shaligrama Haritakiyadi varga In Shalgramanghantubhushanam Vol 7-8 Mumbai Khemraj Shri krishanadas Prakashan,1953 p 81-83
25 Charakacharya In Shastri R et al, ed Charaka Samhita Part II Varansi Chaukhamba Bharati Academy, 1998 p 267-268, 446, 603
27 Shaligrama Dhatupadhatuvarga In Shalgramanghantubhushanam Vol 7-8 Mumbai Khemraj Shri krishanadas Prakashan,1953 p 537-540
28 Prasad AS. Zinc an overview Nutrition 1995 Jan-Feb, 11(1) 93-9
30 Lee K et al. Anti-elastase and anti-hyaluronidase of phenolic substance from Areca catechu as a new anti-aging agent International Journal of Cosmetic Science 2001 December, 23(6) 341-346
31 Isao Kubo et al. Tyrosinase Inhibition Kinetics of Anisic Acid J Naturforsch 2003, 58c 713-718
32 Komarcevic A. The modern approach to wound treatment Med Pregl 2001 Jul-Aug, 53(7-8) 363-8
33 Kazue Tsukahara et al. Inhibitory Effect of an Extract of Sanguisorba officinalis L on Ultraviolet- B-Induced Photodamage of Rat Skin Biol Pharm Bull 2001, 24 (9) 998-1003